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PRINCIPAL CONTENTS


| | PAGE |
|---|---|
| *Features* | |
| Leader: Holiday Jottings | 655 |
| Correspondence | 656 |
| Notes from the Branches | 656 |
| Book Reviews | 666 |
| New Equipment | 667 |
| House Organs | 673 |
| Company News | 675 |
| *Technical* | |
| Thermit Casting | 657 |
| Die-casting of Magnesium Alloys, by T. A. Dickinson | 663 |
| Metallurgical Research at the National Physical Laboratory | 669 |
| *News* | |
| Pattern of the Future | 656 |
| Centrifugal Casting Mishap | 656 |
| Women in a Scottish Foundry | 665 |
| Steel Scrap Missing | 665 |
| Visit to a Plastics Works | 668 |
| New Scottish Research Laboratory | 668 |
| B.I.S.R.A. Activities | 672 |
| Halifax Accident Report | 673 |
| "Blowing our Own Trumpet" | 674 |
| Hayward-Tyler Extensions | 674 |
| B.C.I.R.A. Continental Visit | 675 |
| Personal and Obituary | 676 |
| Mechanical Handling Exhibition | 677 |


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# Holiday Jottings

Deeming a visit to a regional exhibition in a French provincial city as good a method as any of forgetting the abominable cold, rainy weather outside, the writer's thoughts centred on what is necessary in order to sell abroad. The show was mainly devoted to winter-sports wear and equipment, but there was a large hall devoted to domestic appliances. Here were many names familiar to a British visitor—Hoover, Prestcold, Aga, Frigidaire, Bendix, and so forth. Yet there was something a little different in the appearance of their exhibits. In general, the maker's name seemed to be more prominent and on many purely French designs the name stood out in relief. Moreover, there was an accentuation in the design of the controls.

The washing machines were obviously selling well, as they were often—for the countryside—only in competition with open-air "laundries" situated by the river banks. On the other hand, vacuum cleaners found but a limited sale, as the country villas do not buy many carpets, and it is the floor-polishing attachment that had the main appeal. The women's journals were carrying propaganda—complete with an analysis of various types of ownership of houses—for the increased use of carpets, sponsored, we suspect by the carpet-cleaning appliance manufacturers. Practically all the gas cookers shown were adapted to burn either propane or butane, and in this connection it was noticed that in most of the small villages the proprietor of a usually dingy little café was the agent for selling the gas. There, beside the *Arrêt du Police* and the *Tarif des Consommations* were advertisements for the two gases. We are aware that much is being done amongst the large makers of gas cookers, but bottled gas does appear to the writer to have made greater strides in France, owing probably to the lack of towns' gas, except in the larger centres. It was apparent that the standholders at the exhibition were in most cases the local distributors. No doubt the makers of the equipment made a money grant towards the cost of the display. When passing through Dijon railway station, the local publicity was interesting. A loud-speaker informed travellers that they were in the capital of the mustard country; that from it came the best mustard, and finally wished the passengers "*Bon voyage.*" Here is an idea for such towns as Falkirk, where one type of manufacture predominates.

Despite the fact that the (British) Board of Trade issues many excellent booklets on selling in the various countries, it would seem necessary to employ a firm of publicity experts to look at a product from the angle of ultimate purchasers and make alterations to cover the national idiosyncrasies. This does not invariably mean the sacrificing of the essentials which have gone towards creating the goodwill of the article. Gillette advertisements carry the words "Blue Blade" in English, but with a background which is quite French. A feature in selling seems to be a demonstration of a domestic machine in a suitable situation in the small towns on market days by a salesman with the "gift of the gab." A margarine concern was using a particularly gay travelling cinema in the market-place of the larger towns.

## Pattern of the Future

Whether the year A.D. 2000 will have brought spacemen and interplanetary trade delegations is largely a matter for conjecture and strip cartoons, but recently Sir Harold Hartley, F.R.S., put forward some calculations of industrial needs and production when he delivered the first Fawley Foundation lecture with "Science and Industry: the Pattern of the Future" as his subject. The world's industrial requirements by the year 2000 were difficult to estimate; the years since the war had been abnormal and he thought that a likely guess was that industrial output would increase by an annual growth of 3 per cent. compound, provided we escaped the calamity of war. Purchasing power and capital funds would be the limiting elements.

On this assumption, said Sir Harold, output would have to rise by 350 per cent., which meant that the estimated increase in energy consumption would be 125 per cent. and that of raw materials 300 per cent., even allowing for economies in manufacture. The availability of water would determine the future location of industry and the size of industrial concentrations. Surveys and planning were needed to ensure the the utmost use was made of our water resources.

By the year 2000, went on Sir Harold, there would be no global shortage of energy, although its availability might determine where development took place. In 1950, the world's consumption was equivalent to 3,600 million tons of coal; in 2000, if industrial production had risen by 3 per cent. a year, the demand for energy should be equivalent to 7,500 million tons. More metals would continue to be used. The world was rich in iron and aluminium, and on these two metals and their alloys our economy would increasingly depend.

## Centrifugal Casting Mishap

When a casting machine in the foundry of Firth-Vickers Stainless Steels, Limited, ejected molten metal fourteen men were burned, of whom ten were detained in hospital, including a director of the firm, Mr. A. E. Thornton. Of two visiting Rolls-Royce representatives who were watching the machine at the time, one, Mr. H. P. Smith, has since died from his injuries. About 30 cwt. of molten metal had been poured into the machine and it had just started to spin when sparks were seen coming from under the plate. A bang followed and the molten metal sprayed out like a Catherine-wheel. The plate, which measured about 22 in., appeared to have lifted. A charge-hand, George Parker, though splashed by the metal and severely burned, managed to dash to the machine and stop it. Most of the injured sustained burns to legs and arms. An investigation is being made into the cause of the accident.

### Future of the Development Areas

The Government's policy was to continue to strengthen and diversify the industrial structure of the Development Areas, said MR. HENRY STRAUSS, Parliamentary Secretary* to the Board of Trade. The President of the Board of Trade had now completed his examination of those areas and did not consider that he would be justified at present in proposing to remove any of them from the schedule of the Distribution of Industry Act, 1945.

## Correspondence

### NODULAR CAST IRON

*To the Editor of the* FOUNDRY TRADE JOURNAL

SIR,—Mr. S. B. Bailey's article on nodular cast iron is a timely and informative statement upon this new engineering metal, but in his direct and concise approach from the user angle, the author has made some statements which are over-simplified to a degree which makes them inaccurate.

The comment that nodular-graphite cast iron is "almost impossible to weld" is far from the truth. Nodular-graphite cast iron can be welded with rather more ease than flake-graphite iron by any of the generally practised techniques. Furthermore, if the author will try the gas-welding method given in the paper by R. V. Riley and J. Dodd (FOUNDRY TRADE JOURNAL, November 13, 1952, page 555) he will find that the weld metal is of a strength equal to that of the original casting and that the area around the weld and the deposit itself remains soft and machinable and without embrittlement. Furthermore, the weld and the casting, both having an identical microstructure, will not be expected to give unpleasant corrosion effects.—Yours sincerely,

R. V. RILEY,
Research Manager.

Staveley Iron & Chemical Company, Limited,
Near Chesterfield.
May 31, 1954.

## Notes from the Branches

### *East Midlands*

The annual dinner and dance of the East Midlands branch of the Institute of British Foundrymen was held at the Assembly Rooms, Derby. Mr. E. Longden, of Manchester, national president of the Institute, paid tribute to the branch and the honours gained. Also, he said, the branch had the co-operation of a number of outstanding firms, which included Ley's Malleable Castings Company, Limited, Rolls-Royce, Limited, Qualcast, Limited, Butterley Company, Limited, Stanton Ironworks Company, Limited, and S. Russell & Sons, Limited, Leicester. Many well-known engineers and foundrymen were present. During the evening speeches were made by Mr. F. Scopes, managing director of Stanton Ironworks, Company, Limited, and president of the British Cast Iron Research Association and of the Joint Iron Council, and by Mr. D. W. Berridge, chief metallurgist of S. Russell & Sons, Limited, Leicester. The principal guest of the branch was the Mayoress of Derby (Mrs. Gwendoline Russell). Owing to a previous engagement, the Mayor of Derby (Councillor H. J. T. Russell) was not able to attend the function until later in the evening.

THE *Iron Age* has published an interesting graph showing the consumption of zinc, aluminium and magnesium pressure die-castings by the various consuming industries. For most industries, die-castings made in zinc-base alloys predominate—national defence instruments manufacture and photographic equipment being the exceptions. Of magnesium-base alloy die-castings, "motor vehicles" and "machines and tools" are the largest users. It is interesting to note that the motor-car industry used three times the quantity of zinc-base pressure-die-castings as were used of aluminium die-cast alloys and this represented a growth of 31 per cent.

# Thermit Casting*

*By John Steele*

[*Abridged*]

*The purpose of this paper is to focus attention on the Thermit process of producing steel castings. By means of a chemical reaction, molten metal at a temperature of approximately 2,400 deg. C. is produced in a period of 20-25 sec. Quantities ranging from a few pounds to a ton have been obtained by this method. The fact that this may be done on site or in the foundry is emphasized, and the set-up for either type of work is given. The introduction contains a brief historical review of the process in the United Kingdom, United States of America and in South Africa. The materials and equipment are described in section I. Section II contains a detailed description of the procedure adopted for the reaction and pouring of the metal and the scope of the process is summarized in section III. Other uses for Thermit in the foundry are briefly outlined in section IV, and the paper is concluded by a summary of the economic and practical aspects of casting production by Thermit.*

Twelve months ago the editorial introduction to a technical report in the FOUNDRY TRADE JOURNAL† read thus:—

> "The foundryman's dream of having metal of the correct composition and quantity at his disposal merely on the pressing of a button is brought one stage nearer by the cupola charging system described."

It is no exaggerated claim to say that this Paper describes such a push-button system, and it is not a dream, but an accomplished fact.

## Historical Review

The earliest records available on the production of metal by a chemical reaction date back to the closing years of the 19th century. Now, as then, the principal use of Thermit was for the welding of railway and tramway tracks. A secondary, but most important function of Thermit is in the repair of broken shafts, steam-hammer pistons and many other engineering units which can be reclaimed by Thermit welding.

*The United Kingdom.*—The year 1905 saw the procedure established in the United Kingdom for the welding of rails. During the first world war there are records of steel castings having produced by Thermit. Intermittent cases of casting are then recorded and in the years 1945, 1946/7, quantities of mild-steel and stainless-steel castings were produced to help eliminate foundry delivery periods of 12 to 18 months.

*United States.*—The information received from America on this matter is that work was done in conjunction with the Government during world war II, in particular, on the production of emergency castings.

*South Africa.*—Thermit rail welding was first used in South Africa prior to world war II, and according to existing knowledge, the first pour of Thermit for casting purposes was on April 29, 1952. The reason for this cast was the placing of an order with the Author's foundry for investment castings and included in the order were 12 mild-steel castings weighing 3½ oz. each. As no furnace facilities were available for the production of mild steel, it was decided to explore the possibilities of Thermit casting. The necessary equipment and materials were procured and the first cast almost completed the order.

From that date, the production of mild-steel castings by this method became standard procedure. To date, the total weight of steel produced is ¾ ton covering a total of 140 casts. The castings have varied from 3½ oz. to 19 lb.—mostly in the lower range.

## Materials and Equipment

The term "Thermit" is evolved from the root "therm," meaning a unit of heat. Thermit is, basically, a mixture of iron oxide (in the form of rolling-mill scale) and finely ground aluminium powder, grade A, in the proportion of 75 to 25 per cent. To this mixture is added iron, manganese, and ferro-silicon, which, apart from influencing the chemical composition, act as deoxidizing agents. The ignition temperature of this mixture is 1,300 deg. C. and in the reaction thus produced, the aluminium reduces the iron oxide to molten steel, the aluminium itself forming a fluid slag. The amount of steel produced per pound of Thermit is usually 50 per cent., or 8 oz. By the addition of small steel nibs, the yield can be increased to 60 per cent. Thermit mixtures are supplied which contain 15 and 25 per cent. addition of steel nibs. Alloy steels are being produced by the addition of nickel, chromium, molybdenum, and columbium to the Thermit mixture.

It is known that a type of Thermit has been produced in this country but there is no indication that it has ever been used for the production of castings. Careful investigation has shown that the necessary raw materials are not as yet available locally for the economic quantity production of Thermit of the standard required for casting or welding.

*Ignition Powder.*—This is a barium-peroxide powder having an ignition temperature of 800 deg. C.; it is used to ignite the Thermit mixture and commence the reaction.

* Paper presented to the South African branch of the Institute of British Foundrymen.

† "Push-button Control of Metal Composition Envisaged," FOUNDRY TRADE JOURNAL, January 29, 1953, 94, 119-123.

*Thermit Casting*

*Matches.*—The setting alight of the Thermit is a chain reaction which starts at a low temperature. This is achieved by placing several matches in the ignition powder. The normal match-head has a flash point of 250 to 300 deg. C. Having ignited the match-heads, the ignition powder is in turn flashed, and this causes the Thermit reaction to take place, reaching a temperature computed at 2,800 to 3,000 deg. C.

*Thimble.*—An item known as the "thimble" forms the aperture through which the metal and slag stream issues when released from the reaction crucible. This refractory thimble is replaced after every four or five melts.

*Tapping Pin.*—The flat head of a mild-steel tapping pin fits snugly into the thimble and projects through the other end for a distance of 2 to 3 in. This pin is used in conjunction with the asbestos washer and plugging material (ground slag) to prevent the metal from passing through the thimble until desired. This will be clearly described when the procedure for a cast is explained at a later stage.

**Equipment**

An outstanding advantage of the process is the portable nature of the casting unit. The equipment and materials required for a 25-lb. cast of steel can easily be carried in the boot of a car. It is, therefore, possible to have a Thermit cast hundreds of miles from any foundry. The scope of such an arrangement will be readily appreciated, and is a particularly attractive proposition in South Africa.

*For Field Work.*—The reaction crucible is a metal shell into which a lining of dead-burnt magnesite and tar has been rammed. This is subsequently prepared for use by heating slowly at 700 deg. C. and, after six hours at this temperature is allowed to cool in the oven. The crucible is then supplied in this form, ready for use. At the base of the crucible there is an opening which accommodates the replaceable thimble previously mentioned.

An average life of 50 reactions can be expected from this crucible; larger crucibles have an average life of 20 reactions. Proper care of the crucible can prolong its effective life and a patching material of dead-burnt magnesite and sodium silicate can be used effectively. When the crucible lining has completely worn out, the shell may be returned to the suppliers for relining.

The crucible cap, covering the top of the crucible, is of mild steel and prevents the effervescent material during reaction from being distributed over a wide area. A tripod stand supporting the reaction crucible, consists of a top ring with three slots into which the legs fit, this feature, of course, reducing bulk for transportation.

*Receiving Crucibles.*—The crucible is smaller than reaction crucible. A sharp-pointed bar with a material. The major difference is that a pouring lip is incorporated and the bottom sealed. As previously mentioned, the reaction generates metal and slag. Naturally, the metal comes from the reaction crucible first, and is followed by the slag. An experienced observer will note the change from metal to slag, and the receiving crucible is then moved aside to permit the slag to pour into the pan. This pan may be lined with ordinary moulding sand. A pipe with a piece of flat iron riveted to the end, known as the tapping spade, is used to strike the tapping pin upwards to release the metal and slag from the reaction crucible. The sharp-pointed bar with a handle on one end makes a reamer which is used to clear the slag from the thimble aperture after the pour. A skimming bar is used to clean any slag from the surface of the metal in the crucible. A bag containing 25 lb. of Thermit powder and a tin of ignition powder complete the prime requisites.

It will be appreciated that the trestles could hardly be transported in the boot of a car. They are, however, not absolutely essential, as the crucibles can be held away from each other during the reaction and brought forward prior to the tap. This, in fact, is normally the procedure adopted. Likewise, the crucible shank is too bulky for private car transportation, but "piecemeal" shanks are available which are assembled when required.

*In the Foundry.*—The set-up for the foundry is similar in most respects to that for field work, excepting that the reaction crucible is suspended from a chain instead of being mounted on a tripod and the receiving vessel is a standard foundry crucible. The shell of the reaction crucible has holes at various intervals. This enables the lining to dry out easily and allows for the expansion of the shell itself.

In the Author's foundry, the reaction crucible and chain are suspended from a Salter scale. This additional equipment enables the metal/slag line to be arrived at by simple deduction. If the scale pointer registers 60 lb., and the crucible contains 30 lb. of Thermit, when the pointer indicates 45 lb. the receiving crucible is removed, allowing the slag to run into the slag pot. This is a more accurate method of determining the metal/slag border line, than by colour observation.

**Reaction Procedure**

Having set up the equipment, the first operation is to place the thimble in position in the reaction crucible. All three receptacles should then be warmed to drive off any moisture or chill. This may be done with a blowlamp or by placing them over a fire before setting into position.

The tapping pin is now placed into the thimble, the head resting on the top surface and the stock projecting 2 or 3 in. beyond the crucible base. Next, the asbestos washer is placed on top of the pin, and the plugging material poured over that to a depth of $\frac{1}{4}$ to $\frac{1}{2}$ in. This ensures that the metal shall not prematurely leak from the crucible. The required quantity of Thermit is then weighed out, and thoroughly mixed before charging into the crucible. The Thermit should be heaped to form a cone on the top surface. A small indentation is made on the apex of the cone, and into this the ignition powder is placed. Sufficient ignition powder to cover a sixpence, and of the same depth, is considered ample, irrespective of the weight of the Thermit used. Three or four match-heads are next broken off and inserted into the ignition powder.

with the heads projecting slightly. Finally, the cap is placed in position and the weight on the scale checked.

The yield anticipated is deducted from the recorded weight and the resultant figure determines when the receiving crucible should be removed to obtain slag-free metal. With this method, little experience is necessary to obtain accurate results, having no slag in the metal and no metal in the slag.

The next step in the procedure is to ignite the mixture and four methods in use are as follow:—

(1) An iron rod is heated, at one end, to a red heat and the hot end buried in the ignition powder and matches.

(2) A lighted "chisa" stick as used on the mines for charge ignition, can be placed in contact with ignition powder and matches.

(3) The crucible cap may be raised at one side and the matches ignited by means of a blowlamp.

(4) A small fusee, charged with ignition powder and connected to a battery, is placed on top of the Thermit. On depressing a button, the wires in the fusee flash and ignite the powder. This method is particularly applicable where several crucibles of Thermit have to react simultaneously.

All the foregoing methods are satisfactory. The blowlamp method is used in the author's foundry. The ignition may take from 1 to 5 sec. and immediately it commences, the igniting medium is withdrawn, the cap closed and the reaction will proceed forthwith.

The reaction is marked by sparks and smoke issuing from the crucible cap opening, and a violent turbulent action inside the crucible. From the moment of reaction, a count is taken (by a stopwatch or similar means). At approximately 20 sec. the turbulence will cease, indicating the final separation of slag and metal, and at 25 sec. the tapping pin is given a sharp upward blow which shoots pin, asbestos washer and plugging material into the molten metal. The pin dissolves and simultaneously the metal pours into the receiving crucible, which is removed on the commencement of the slag stream. If checked by weight, the crucible is removed when the predetermined figure is recorded on the scale.

The total time from ignition to the completion of the pour is about 30 sec. for a pour of 15-lb. of steel. The reaction time has little variation irrespective of volume of metal produced, and the difference in total time alters slightly depending on the volume of the melt passing through the thimble. The next operation is that of clearing the thimble of any slag which may be trapped. This is effected with the reamer provided, by rotating it, and tapping gently with a hammer until the hole is cleared. This should be done immediately the crucible is clear of metal and slag. Careful attention to this will assist greatly in the extension of thimble "life."

It will be observed that the wall of the crucible is covered with a thin layer of slag. This should not be disturbed, as it prevents further erosion of the lining taking place to any great degree during subsequent reactions. The operators must wear goggles. This is a necessary precaution due to the intense glare from the reaction and metal. The temperature of the metal as poured from the reaction crucible is in the region of 2,200 deg. C. In spite of the fact that there is a chilling effect from the receiving crucible, it is usually necessary to have a waiting time of two minutes before pouring the metal into the mould. From this, it will be noted that the total time from ignition to completion of pour is normally three minutes for a melt of 15-lb. of steel.

Provided the thimble aperture has been properly reamed, it is possible to proceed immediately with a further cast. Should several consecutive casts be required, the usual procedure is to set up two or more reaction and slag crucibles. Thus, while one crucible is being reamed and charged, the reaction may be proceeding from another crucible.

To conclude this section, the following important points are repeated:—

(1) All crucibles should be warmed before use.

(2) The correct setting of the tapping pin, asbestos washer and plugging material will prevent any premature leak of metal.

(3) The tapping pin must be given a sharp blow to clear the thimble for the metal stream. Failure to do this may result in a blocked tap-hole.

(4) Immediate reaming of the thimble will lengthen its useful service "life."

## Scope of the Process

*Weight Range.*—The complete range of crucibles and approximate steel recovery are as follow:—

Crucible No. 1, 3 lb.; No. 2, 5 lb.; No. 3, 10 lb.; No. 4, 16 lb.; No. 5, 24 lb.; No. 6, 35 lb.; No. 7, 77 lb.; No. 8, 117 lb.; No. 9, 149 lb.; and No. 10A, 244 lb.

It will be noted that the largest quantity of steel produced is 244 lb. This capacity can be increased to a total of 430 lb., by the addition of a specially-lined extension ring being fixed on to the 10A crucible. It is, moreover, possible to melt larger quantities merely by increasing the number of crucibles. For a certain welding job in Scotland, a total weight of 3,136 lb. of Thermit was ignited, using four 10A crucibles fitted with extension rings. The Thermit was reacted in all crucibles simultaneously, and the metal poured down separate runners. For casting purposes, the metal from each crucible may be tapped into a common ladle.

*Metal Composition Range.*—Various chemical compositions can be produced by Thermit, three typical examples being as quoted in Table I.

The physical properties of steei (*c*) are as follow:—

| | As-cast. | After normalising and heat-treatment. |
|---|---|---|
| Yield point, tons per sq. in. .. | 17.5 | 16.65 |
| Tensile strength, tons per sq. in. .. | 31.3 | 30.9 |
| Elongation on 2 in., per cent. .. | 23.3 | 30.1 |
| Reduction in area, per cent. .. | 31.8 | 51.2 |

With careful research, there is no doubt that the Thermit metallurgist can produce a variety of alloy

steels to meet many of the present engineering demands.

*Range of Castings.*—Amongst the types of castings produced by Thermit are those of stainless and mild-steel, made from dry-sand moulds. The castings produced in South Africa, from investment moulds, are mainly of mild steel, and include gas-compressor valve-seats, fulcrum shaft levers, core pins used in a metal die for rubber processing; dies used for porcelain manufacture and throttle valve handles.

TABLE I.—*Three Examples of Steel Compositions Produced:*

| | (*a*) per cent. | (*b*) per cent. | (*c*) per cent. |
|---|---|---|---|
| Carbon .. .. | 0.04 | 0.3 to 0.35 | 0.25 |
| Silicon .. .. | 0.23 | 0.35 | 0.11 |
| Manganese .. .. | 0.52 | 0.9 to 1.1 | 0.68 |
| Phosphorus .. | 0.04 max. | 0.03 max. | 0.02 to 0.04 |
| Sulphur .. .. | 0.04 max. | 0.04 max. | 0.02 to 0.04 |
| Nickel .. .. | 8.76 | — | — |
| Chromium .. .. | 18.87 | — | — |
| Aluminium .. .. | — | — | 0.6 to 1.0 |

*Moulds.*—It has already been stated that all the Thermit steel produced in the Author's foundry has been poured into investment moulds, and it will be appreciated that, besides other advantages, this type of mould is ideal from a refractory point of view. A good quality dry-sand mould is also satisfactory and the following is a typical composition being used in South Africa for Thermit moulds:—

100 lb. .. yellow sand.
3 lb. .. binder (S.A. type of bentonite).
6 pints .. water.
1 pint .. molasses.

The screen analysis of the yellow sand is as follows:—

Mesh No. 20, 0-0.5; 30, 2-3; 45, 9-11; 50, 19-23; 70, 20-25; 100, 16-21; 140, 9-11; 200, 3-4; 270, 1-2 per cent. retained; and pan, 1.5-2.5 per cent.; clay grade substance,10.5-13 per cent., and A.F.S. fineness No., 65-75; percentage on three adjacent sieves, 60.

For the production of small, intricate castings from shell moulds, the Thermit casting process would appear to have many advantages.

## Other Foundry Uses

While the main purpose of this Paper is to discuss Thermit castings, it is felt that it will not be amiss briefly to mention other uses for Thermit in the foundry.

*Feeding Compound.*—Metal yield plays a most important part in every foundry's economy and any means to give increased yield is important. Thermit can be used in two forms to attain this end.

(*a*) *Riser Addition.*—In its original form, Thermit may be added to the top of the metal in a partially filled riser. By careful and constant addition, a reaction is sustained; this keeps the riser hot and at the same time supplies a quantity of molten metal to compensate for the liquid shrinkage taking place.

(*b*) *Exothermic Sleeves.*—Thermit is the main constituent in the exothermic feeding compounds which are used in the manufacture of sleeves to be fitted into feeding heads. A small quantity of magnesium powder, to act as a starter, is mixed with the Thermit. To this mixture is added a binding agent to enable the desired form of sleeve to be retained. Another addition to the mixture caters for the permeability of the sleeve. When the molten metal enters the feeding head and comes in contact with the sleeve, a thermal reaction takes place, which increases and maintains for some time, the temperature of the metal in the head. This assists the progressive solidification of the casting.

*Ladle Additions.*—Certain proprietary ladle additions contain a percentage of Thermit. This generates heat in the metal at the time of addition. This heat compensates for the possible chilling effect of the alloying additions and increases the temperature of the metal to assist in the complete and homogeneous mixing of the alloys.

*Casting Repairs:* (*a*) *Burning On.*—Unfortunately, all foundries have their misfortunes one way or another. Two such are the short running of a section of a casting, and insufficient feed metal, resulting in a bad "draw" at some vital point in the casting. If the casting warrants being reclaimed, an effective process is by "burning on." One of the problems in this method is to obtain sufficiently hot metal for the "weld." Metal produced by the Thermit process is ideal for such a job, and may be poured direct from the reaction crucible into the prepared mould. The slag which follows the metal will form an insulating cover on top. The most important point, of course, is to ensure that sufficient metal is melted to meet the demand.

(*b*) *Broken Castings.*—This is more an engineering than foundry problem, but it is recorded here as a matter of general interest, because occasionally foundries are requested to repair broken castings. The example to be quoted is a broken cast-iron bedplate at one of the South African gold mines. To replace the casting, a delivery of several months was quoted. Apart from the inconvenience, this situation would have been intolerable in view of production requirements and it was therefore agreed to repair the break by Thermit welding.

The total casting weight was 2½ tons and the job measured 10 ft. long by 2 ft. wide by 3 ft. maximum height. The bedplate was initially set level with a gap of ¾ in. between the ends to be welded. The entire gap was built around with a mixture of paraffin and beeswax, to the thickness required for the final metal weld. Pouring gates and risers were placed in position and a specially fabricated moulding box placed over the entire section to be welded. This was then rammed up with moulding sand, and the runners and risers withdrawn. Through two holes known as preheating gates, paraffin atomizer burners were placed, and, commencing with a slow flame, the wax collar was melted out, the wax running out through de-waxing holes in the base. When satisfied that the wax was completely removed, the burners were adjusted for normal preheating of the area to be welded, at the same time, drying out the mould. Parts of the bedplate protruding from each side of the moulding box were bricked up, forming

a furnace in which fires were kept burning, thus heating the entire job during preheating of the area to be welded.

A No. 8 crucible was set up above the pouring gate, 250 lb. of Thermit being charged, estimated to fill the cavity and runners with 130 lb. of metal. When the broken section had attained a temperature of approximately 650 deg. C. (six hours after the commencement of preheating) the paraffin burners were withdrawn and the preheating and de-waxing gates plugged with dry-sand cores.

The Thermit in the crucible was then reacted, the crucible tapped and the metal poured into the mould. The resultant slag was run off from the side of the pouring head. After welding, the casting was allowed to cool slowly for 48 hours. Upon stripping, the casting was checked, found to be dimensionally correct and the weld 100 per cent. sound. The casting was in service within five days from the commencement of the Thermit welding operations.

### Economic Considerations

In assessing the value of any process to industry, normally the most important factor is the economic one. So it is with the Thermit process. As always, this is a question for the individual founder to answer, and this can only be done by a complete survey of all the facts involved. The method has undoubtedly proved economical from the point of view of investment castings. It should, of course, be borne in mind that these castings are more expensive on a cost-per-lb. basis than ordinary sand castings.

(*a*) *Capital Outlay on Equipment.*—As a guide to the initial costs, it can be stated that at current market prices, £20 0s. 0d. would be required to establish Thermit casting in any foundry, to melt, say, quantities of 25 lb. of steel. By comparison with the capital outlay required to commence steel-melting operations, this figure looks quite ridiculous.

(*b*) *Material Costs.*—It cannot be denied that the Thermit mixture cost is the most important factor in the economic evaluation of the process. It is, however, reasonably safe to say that the more widely the process is used, the greater the demand for basic materials, so the stronger the possibility of these materials being reduced in price to a more economic figure.

(*c*) *Labour Costs.*—The melting section of every steel foundry employs quite a large labour force for the handling of raw materials, melting and casting operations. For Thermit casts a labour force of four is ample, and, in most cases, only three are required; (two Europeans and one native under South African conditions). Another very important point is that, apart from the actual pouring of the moulds, no skilled labour or metallurgical knowledge is required.

(*d*) *Time Factor.*—Allowing 30 min. to prepare for the initial cast, on the average, subsequent casts are obtainable every three to five minutes.

### Practical Considerations

The production of castings using a Thermit mixture is a practical proposition which has been proved under normal, everyday conditions. The following advantages can be claimed for the process:

(*a*) *General.*—(*i*) Every foundry can produce steel castings; (*ii*) metal, when, where and in any quantity required; and (*iii*) small floor area required.

(*b*) *Metallurgical.*—(*i*) Guaranteed consistently correct analysis; (*ii*) metal free from dirt and inclusions; (*iii*) steel is never "wild"; (*iv*) gas-free metal; and (*v*) high temperature of metal enables thin-section castings to be poured satisfactorily.

*Precautions.*—Before concluding the Paper, it is deemed advisable to mention the precautions necessary with Thermit.

1. The operators should always wear protective goggles.
2. The Thermit must be stored in a dry place.
3. The ignition powder must also remain free of moisture, and, in particular, should be kept well away from the reaction area to prevent any stray sparks from setting it alight.

### Acknowledgments

The Author wishes to record his thanks to the directors of Rely Products (Pty.) Limited for their permission to prepare and publish this Paper. Sincere appreciation is also accorded to Mr. J. T. J. Bird and his principals, Murex Limited, Rainham, England, for their generous and practical interest. Thanks are also due to the Metal and Thermit Corporation of New York for the information given on Thermit casting in the United States of America.

## Centenary of George Eastman

To commemorate the hundredth anniversary of the birth of George Eastman, a postage stamp will be issued bearing his portrait, it was announced recently by the U.S. Postmaster-General. It will be one of the "Famous American" series. George Eastman, who has been called the father of modern photography, was born in the village of Waterville, New York, on July 12, 1854. At 14, poverty forced him to leave school and he got a job as a messenger boy to an insurance firm at $3 a week. He first became interested in photography at the age of 23. After mastering the clumsy wet-plate process then in general use he turned his attention to the newly-invented gelatine dry plate. In 1879 he received a patent for a plate-coating machine, and in a very few years time substituted for glass his perfected system of roll-film photography. In 1888 he brought out a greatly simplified camera which he called the "Kodak"; anybody could take pictures with this box camera and no skill was required beyond the ability to press a button. George Eastman was known as a philanthropist almost as well as he was known as the creator of a new era of photography. He gave dental clinics to London, Paris, Rome, Brussels and Stockholm, and large sums of money to educational institutions. In all he gave away over one hundred million dollars. An exhibition commemorating the centenary will be held at the Royal Photographic Society, 16 Princes Gate, London, S.W.7, during the month of August.

IDEAL BOILERS & RADIATORS, LIMITED—Owing to pressure of his business commitments overseas, Lord Trefgarne has resigned from the Board.

# Film Reviews

**"The House That Jack Built"**

This is a cartoon film produced by the Federation in order to aid the scrap drive. It was originally produced for scrap-drive committees but would form an amusing addition to any series of films shown to a technical audience. It is available in 35 or 16 mm. sizes.

**"Formation of Bainite"**

This film illustrates the work carried out by Dr. T. Ko and Dr. S. A. Cottrell at Birmingham University for the British Iron and Steel Research Association. It explains by means of diagrams the essential structures that form during the heat-treatment of steel, and shows by means of time-lapse photography the actual formation of martensite and bainite in steel specimens at high temperatures under a "hot-stage" microscope. The formation of martensite has been filmed before, notably by Dr. Wiester in Germany, but this is the first successful technique developed for filming the formation of bainite. The film is 16 mm. with commentary, and is available on loan free of charge from **B.I.S.R.A.**

**"Blister Steel"**

The British Iron and Steel Federation have placed on record the methods used to make blister steel by the old cementation process. The last Sheffield furnace making this type of steel finished operation in October, 1951, in order to make room for the new laboratories of B.I.S.R.A. All the stages of the diffusion, or cementation process are portrayed in the film, and the shots of the basic operations are of particular interest. They show how the raw material, wrought-iron bars, instead of being melted, were soaked at red heat for a week or more in airtight chests containing charcoal, absorbing carbon from the charcoal and turning into steel. The resulting "blister bars" would take a good temper but lacked uniformity. This was remedied, as is shown in the film, by breaking the bars into small pieces and remelting them in a refractory crucible. (Previous to 1740, the bars were broken in half and hammered into piles to make "shear steel.")

**"Inside Story" or "At Home with the Jones's"**

Last week, this new film which quite frankly advertises the "Jones" range of mobile cranes was given its *première* in London. These cranes are produced at the Letchworth works of K. & L. (Steelfounders and Engineers), Limited, one of the "600" Group of Companies. As would be expected from an industrial "at-home" film, the viewer is taken through the works.

However, there is a difference from the usual run in that the first scenes are of the firm's silver jubilee gala held last year, introducing the film's basic theme, "We've something to celebrate and be proud of." For the most part, the film is intended for showing to prospective customers, who are laymen as far as foundry and engineering are concerned. Far better, therefore, than "blinding them with science," the film commentary is also given by a layman—Mr. John Stater, quite well-known to audiences in this country. Bearing this in mind, one can forgive the slip when he refers to the steel being tapped from the arc furnace into a "crucible" instead of the ladle it obviously is.

The story is well told; the steelfoundry shots are impressive; enough and no more "scientific control" is introduced and the climax, where the machines perform acrobatics on test—among others, bending the plate glass and cracking the egg—is nicely brought out. It is a colour film, running for 35 mins., which the reviewer considers admirably suited to its purpose.

# Publications Received

**Hydraulic Machinery and Equipment.** Taking the form of a product directory the Hydraulic Association, 94/98, Petty France, London, S.W.1, has issued a novel sort of catalogue on behalf of its fourteen members. On each double page the product is listed in the first and final columns and across the top the names of the members are given. Stars indicate the supplying firms. Under "presses" no fewer than 125 varieties are listed. It is a very useful work of reference and is available to readers on application to the address in Petty France.

**El Salvador—Economic and Commercial Conditions,** by A. W. D. Eves. Published for the Board of Trade by H.M. Stationery Office, York House, Kingsway, London, W.C.2. Price 1s. 6d. net.

This most interesting publication gives information as to the trading conditions of El Salvador up to the end of 1952. From it one learns that it is the most densely populated country of South America; that it is exceedingly prosperous, and that it operates three small foundries. The economy of the country depends mainly on coffee and to a lesser extent on cotton. Industry now embraces shoe manufacture and furniture making; flour and cotton mills, so the three small foundries should be growing.

**O.E.E.C. at Work for Europe.** Published by the Office for European Economic Co-operation, 2 rue André-Pascal, Paris, 16.

The reviewer believes that the letters O.E.E.C. are more familiar to readers than the work it undertakes. Most foundrymen know that it is actively interested in productivity and sponsors visits of teams to the United States. They are, however, probably unaware of many other activities connected with the European Payments Union; such as special technical committees; raw materials; co-ordination of industrial investments; maritime and inland transport; and the like. All these subjects are fully dealt with in this publication which can be had gratis on writing to the head office in Paris.

**Department of Scientific and Industrial Research—Report for the year 1952-53.** Published by H.M. Stationery Office, York House, Kingsway, London, W.C.2. Price 8/- net.

The Department of Scientific and Industrial Research is responsible for the expenditure of over five million pounds and is of cardinal importance to the present and future welfare of this country. Whilst it sponsors great projects, it is not above pointing out such a simple matter as that closed windows and doors will restrict fires. That is why it is advisable to have no windows and tightly fitting doors to pattern stores.

The direct interest of the foundry industry in the work of the D.S.I.R. is the support it lends to the British Cast Iron Research Association, the British Non-ferrous Metals Research Association and the National Physical Laboratory, but indirectly many other research associations such as those covering iron and steel, and the motor vehicles, and even roads produce results of importance to the industry.

The report on the British Cast Iron Research Association occupies three and a half pages and a proper appreciation of the great amount and diversity of work undertaken is presented. That of the B.N.F.M.R.A. devotes its first particularized section to "Saving Metal and and Labour in the Foundry."

The book runs to over 300 pages and it sets out in detail what is being done in dozens of laboratories throughout the country for the acquisition of new knowledge.

# Pressure-die-casting of Magnesium Alloys

*By Thomas A. Dickinson*

*In this description of an American plant, the economic advantages of using die-assemblies built from as many standard components as possible are stressed. Electric-furnace melting units have superseded gas-fired equipment.*

By developing unusually effective methods of die-casting for magnesium alloys, McCulloch Motors Corporation of Los Angeles have been able to reduce castings rejects due to temperature variations to less than 0.5 per cent., minimize the danger of fire, improve working conditions, and accelerate production. In fact, this is said to be one of the main reasons why the McCulloch concern is to-day amongst the world's largest producers of petrol-powered chain saws. A complex casting of this type is shown in Fig. 1.

Magnesium alloys are adopted for the manufacture of products like chain saws, because their extreme light weight permits the production of final assemblies which are portable, despite relatively large dimensions and complex construction. A typical saw, weighing 49 lb., comprises 23 magnesium pressure-die-castings with a weight of 18 lb. Dowmetal R is the most commonly-used magnesium alloy for these purposes.

## Melting

The initial step in preparing Dowmetal R for pressure-die-casting operations at this firm consists of warming and drying 25-lb. ingots in a gas flame. This removes entrapped vapours which might cause explosions. Next, the ingots are placed in an 80-kw. 1,000-lb. electric-resistance breakdown furnace which is controlled by a panel with two in-series pyrometers. One of the latter is a control thermocouple which is used to set the maximum limit of heat for the magnesium (about 700 deg. C.) while the other is an anticipating type of thermocouple which brings the magnesium up to the desired working temperature (about 660 deg. C.). About two hours are required to bring the first pot up to temperature, after which the process is continuous.

Gas-type heating equipment, formerly used by McCulloch in melting magnesium, has been completely replaced, because the corrosive effects of fumes produced in burning gases necessitated the frequent repair or replacement of sensitive gas/air regulators, mechanical and electrically-controlled valves, etc. Besides minimizing the need for maintenance, currently-used electrical furnaces reduce sulphur-dioxide flux requirements by about 95 per cent., because it is possible to bleed bottled sulphur dioxide over the surface of hot magnesium materials. Further, because electric-furnace temperatures can be controlled within tolerances of $\pm$ 1 deg. C., the new heating equipment helps prevent porosity and related defects in the castings.

Molten magnesium alloy, with a specified die-casting temperature, is poured as needed into a 400-lb. capacity transfer furnace which has a 700 deg. C. pot temperature. A fork-lift truck is used to convey transfer furncaes to and from the electric furnaces and the 21 pressure-die-casting machines.

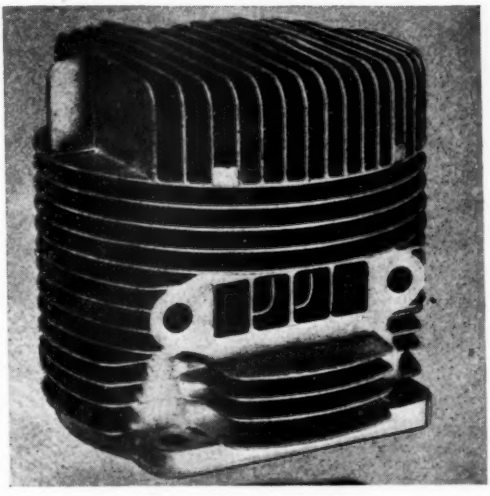
Heat losses in materials transferred from the electric furnaces are usually such that the best-possible casting temperature (660 deg. C.) is attained. Castings are then produced at rates as high as four per minute per machine.

## Die Production

Although most die-castings are mass-production items, this concern can economically die-cast fewer than 500 duplicate parts, because the company has evolved a method of fabricating steel die set-ups which can be used for either large or limited-production runs without increasing manufacturing costs as much as might be expected.

Such dies are made by assembling a number of different die components, instead of by machining solid blocks of steel in the usual manner. Assembled dies are advantageous because: (1) certain standardized parts can be recovered for further use after a given die has served its production purpose, and (2) burned or damaged dies do not have to be

*Fig. 1.—Magnesium-alloy cylinder-head pressure-die-cast by McCulloch Motors Corporation.*



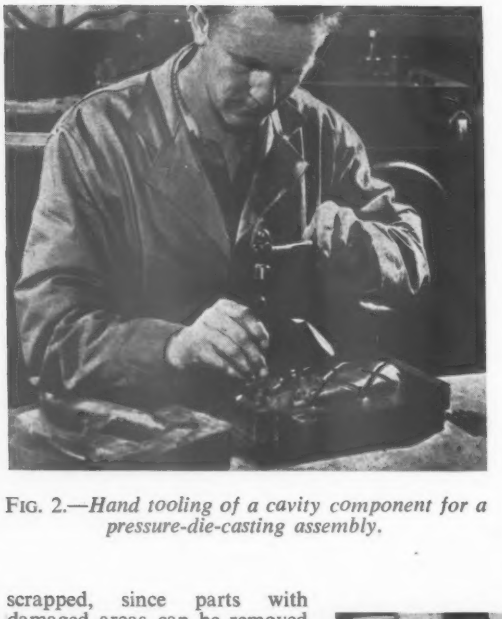


FIG. 2.—*Hand tooling of a cavity component for a pressure-die-casting assembly.*

scrapped, since parts with damaged areas can be removed and replaced.

The basic components of each die-assembly is a steel block, the centre section of which has been machined so that a variety of cavity components can be assembled rapidly therein. This block represents more than 50 per cent. of the steel that is normally only fit for salvage when a conventional die is taken from the production line. Yet, because of its standardized details, a block can be re-used indefinitely.

Many cavity components to fit in the die block must naturally be made to suit each order, a typical example being shown in Fig. 2. However, this is not an inherently expensive process because most cavity designs can be broken down to the point where die parts can be machined or otherwise fabricated without special patterns. Further, some cavity components—such as ejector pins and clamps—have been standardized so that they too can be re-used as long as they are undamaged.

Both single and multiple-cavity dies are being fabricated by this company for die-casting purposes. The multi-cavity dies are generally used for the simultaneous production of two or more identical articles, not two or more different articles, because few (if any) dissimilar parts are needed in identical quantities.

### Tolerances

Tolerances for critical dimensions in these die assemblies range from ± 0.010 in. to ± 0.001 in. Flash due to the use of assembled dies is said to be no greater than the flash produced in using conventional dies, because of the close-tolerance dimensions of the assemblies and the tendency of molten magnesium alloys to solidify rapidly when they come in contact with cool steel surfaces. A finished casting, and the die-assembly from which it was produced, is shown in Fig. 3.

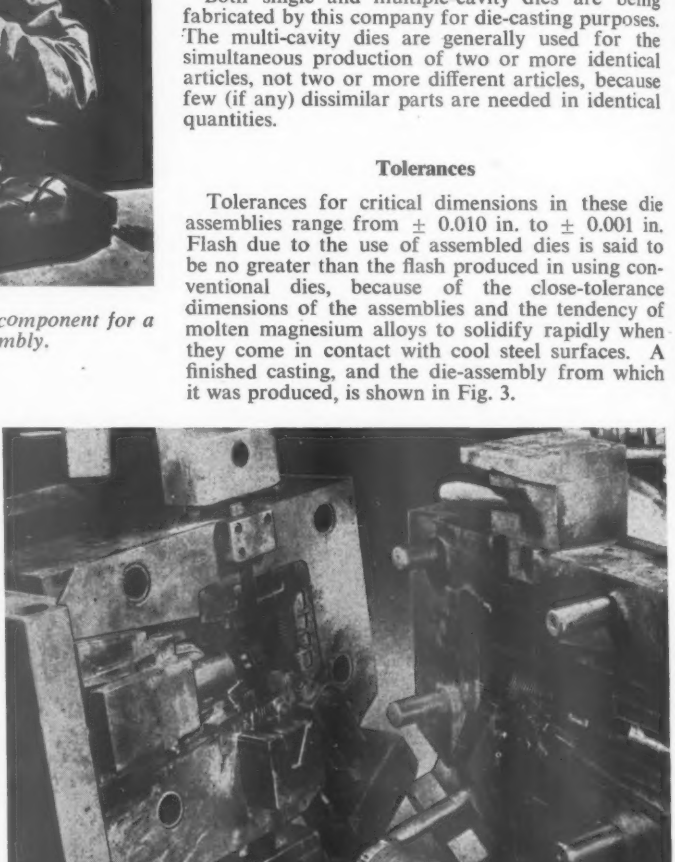


FIG. 3.—*Two steel die-assemblies and the air-cooled motor component produced from them.*

THE ENGLISH ELECTRIC COMPANY, LIMITED, have made an 18-minute film of their own apprenticeship scheme which explains the various stages of training opportuntities and facilities which are afforded; it is intended to encourage schoolchildren to make engineering their career. The film is shortly to be shown to the 320 apprentices at the Phœnix Works, Bradford, and it will also be shown at schools and technical colleges throughout the country.

THE NEW OFFICE BLOCK at the Wickman, Banner Lane factory, Coventry, built as a result of the destruction by fire of the previously existing accommodation, has now been completed. The new building is of reinforced concrete construction throughout, and provides 35,000 sq. ft. accommodation on two floors. The "Frenger" system of heating has been adopted throughout, heat being radiated from the ceiling downward through perforated ceiling panels.

## Women in a Scottish Foundry

One war-time innovation that has continued, largely because of the management's satisfaction, is the employment of women in the foundry of Bonnington Castings Limited, Leith, and, so far as this particular firm is concerned, there is no prospect of the works becoming once again an all-male "shop." Certainly, both the number of women employed and the scope of the work that they undertake have dwindled considerably since the war, but the foreman of the coreshop—where they work now—and the assistant manager, confirm that the girls are in many ways well suited to that particular job.

Nowadays there are only about 20 girls engaged in the actual foundry, compared with 180 in 1944, and almost all are employed in making cores for the castings. Ten years ago, they were responsible for much of the work that is now done by men—crane-driving, dressing, electrical welding, casting, and moulding-machine operating—and a number of these employees are still with the firm.

The firm is specially concerned with the manufacture of valves for oil-refining machinery and vehicle manufacture, and many of the cores made are for 15-in. valves. The personnel pride themselves on the fact that all the cores needed are made by women; who also paint the cores after baking and assemble them if required. Special arrangements are made to allow married women to work half-shifts, so that they can look after their homes as well. This means that they put in four five-hour shifts per week instead of the two ten-hour shifts of the unmarried women, although normally, all work a 44-hour week. Core-making rates as semi-skilled labour, the girls undergoing a stipulated training period of up to six months before qualifying for full pay.

### Welfare

In the foundry is a first-aid and rest room, where Nurse Elliot is in charge; she has been at Bonnington for 13 years. She is not kept very busy, although there are a certain number of minor injuries which require attention. The most frequent are burns, abrasions—caused usually by letting things fall on the feet—and crushing, through having fingers caught in a machine. There have been more serious accidents occasionally—one man, for example, caught his arm in a conveyor belt. A doctor visits the works once a week. Another important medical safeguard is the annual visit of the X-ray unit.

## Award Scheme Extended

The scope of the National Light Casting Iron Founders' Federation award scheme is to be extended to include students attending Burnbank Foundry Trades Centre, as well as the evening classes at Falkirk Technical School Further Education Classes. Some time ago this Federation established a fund for the provision of prizes for students attending Technical School Evening Classes and made subscriptions to the fund at regular intervals. The Burnbank Centre has been opened since the institution of the fund and provides courses of study similar to those provided at the Technical School. Replying to the suggested extension, the Federation agreed that the prizes awarded from the Ironfounders' Prize Fund for students attending the evening classes in Falkirk Technical School should remain the same as at present and that the fund be extended to include students at Burnbank, but that only a first prize be offered for each group in each year.

## Steel Scrap Missing

When the case against three of ten men accused of conspiracy to defraud a steel firm was opened at Wednesbury Magistrates' Court last month, it was stated that the firm found a shortage of 3,200 tons of steel scrap, worth £23,200. Prosecuting, Mr. Frank Cooper said F. H. Lloyd & Company, Limited, James Bridge Steel Foundry, Wednesbury, found their steel scrap stock was diminishing, which was surprising because their purchases had been more than previously but consumption of the material had been constant. When proper stocktaking was made, said Mr. Cooper, it was found that between April 1 last year and January 31 there was a shortage of 3,200 tons of steel scrap, representing, in cash, £23,200.

The police interviewed people delivering scrap to the firm, among whom were the three men before the Court. They were a metal merchant, L. P. Rock, aged 62, of Halesowen, his lorry driver son, and C. T. Singleton, also a lorry driver, of Dudley. They were charged with conspiring with H. V. Hunter, now deceased, to cheat and defraud F. H. Lloyds by falsely pretending they had delivered scrap in excess of the amounts actually delivered.

Mr. Cooper said control of the firm's scrap dealings was in the hands of Mr. R. W. Hampton, who unfortunately died after the investigation had been started. Hunter was the weighman employed by the firm and after he had been interviewed each of the three men admitted their part in the fraud. Hunter took his own life on March 29. His duty was to weigh vehicles going into the works and initial the tickets of the carters. It was arranged with the weighman that incorrect weights should be put on the tickets and if a load weighed two tons it was initialled by Hunter as four tons. The three men were committed to the Stafford Assizes, each on bail of £100.

## Aluminium Research Scholarship

The Institution of Structural Engineers has accepted an offer by the Aluminium Development Association of a research scholarship to the value of £400 a year to enable the holder to undertake research on some aspect of the application of aluminium alloys to structures. The scholarship will be awarded in alternate years for a two-year period. It is the intention of the Council of the Institution to make the first award in the near future in order that the successful holder may commence his investigations in October, and entries for the scholarship to be awarded this year close on July 15. The scholarship is to be administered by the Institution and further particulars, together with forms of entry, should be obtained from the secretary, Institution of Structural Engineers, 11, Upper Belgrave Street, London, S.W.1.

### Monopolies and Restrictive Practices

In accordance with the provisions of the Monopolies and Restrictive Practices Commission Act, 1953, the chairman of the Commission has appointed the following group to continue the investigation and to report on the Commission's references concerning—*inter alia*—the supply and export of certain non-ferrous metal products:—Mr. D. A. S. Cairns, Q.C. (chairman); Professor G. C. Allen; Mr. J. Archdale; Mr. W. G. Cullen; Mr. B. Davidson; Mr. C. N. Gallie; Mr. C. H. P. Gifford, O.B.E.; Professor A. L. Goodhart, K.B.E., Q.C.; and Mr. G. G. Stott, Q.C.

# Book Reviews

**Industry and Science.** A report published for the Manchester Joint Research Council by the Manchester University Press, 316, Oxford Road, Manchester. Price 12s. 6d.

Because it has so often been stated that British industry insufficiently applies research data to its manufacturing problems, the Manchester Chamber of Commerce and Manchester University formed a joint committee to report on the subject, and this book is the outcome of its work. The main conclusion is—as might have been expected—the absence of any "uniform pattern." The book contains many pages of statistics, but as there is no "uniform pattern," the reviewer, like the committee, can draw no useful conclusions.

V. C. F.

**Legierungs-Handbuch der Nichteisen Metalle (Alloys Handbook of Non-ferrous Metals),** by Ernst Brunhuber. Published by Fachverlag Schiele und Schön, 10 Boppstrasse, Berlin, S.W.29, Germany. Price D.M. 21.

In this 200-page book there are 1,391 alloys listed and numbered. Their compositions are detailed, but there is no source of origin given. The range is particularly wide, and whilst covering all the usual alloys, also embraces the precious metals. In many instances equilibrium diagrams are included. The alloys listed are by no means purely German, and many references to alloys of other origin are listed. It is interesting to note that so far as this book is concerned Silal is an aluminium containing 1.5 to 4.5 copper; 0.6 to 1.2 magnesium; 0.6 to 1.0 manganese, and 0.3 to 0.6 per cent. silicon, whilst in this country it is a special cast iron.

This book, being mainly composed of tabular matter and diagrams, does not suffer much—from the English readers' point of view—by being printed in German. It provides useful work of reference for those desiring to know the nature of known alloys entering into the non-ferrous field.

**Metallurgical Analysis** (2nd Edition, revised) by W. A. Naish, Ph.D.; J. E. Clennell, B.Sc.; and S. Kingswood, M.Sc. Published by Chapman and Hall, Limited, 37, Essex Street, London, W.C.2. Price 75s. net.

In this, the second edition of a book first published in 1929, efforts have been made to bring the information up-to-date while keeping to the set-up of the first edition. Special emphasis has been laid on technical methods and the help of a panel of specialists was enlisted to assist in certain branches of the work.

The subject matter is divided into six parts and an Appendix. Part I deals with sampling, methods of solution and separation and qualitative analysis. Part II gives selected methods for the analysis of the elements and Part III describes the analysis of commercial metals and alloys. Part IV is devoted to ores and slags and Part V to refractory materials and coal and coke. Part VI is given to modern physico-chemical techniques and in the appendix are details of standard solutions, tables of atomic weights and gravimetric factors and notes on the care of platinum apparatus. It can thus be seen that the authors have attempted to cover the whole range of metallurgical analysis in one volume and the amount of information that has been crammed into its 650-odd pages is immense.

The layout of the book is good, having, as it does, the selected methods followed by the applied procedures for commercial metals and alloys, etc. These are, on the whole, well chosen and capable of giving accurate results. The sections dealing with specialized analyses are authoritative, and the methods given are generally excellent, though exception could be taken to some of those recommended for copper and copper alloys.

No book on analytical methods can satisfy the personal preferences of all, but, setting these aside, it is inevitable particularly in a volume with as wide a range as this one, that there should be some grounds for criticism. It is astonishing to find in a book designed for both students and metallurgical chemists, the recommendation that the drying of precipitates at about 100 deg. C. should be carried out on tarred filter papers. Such rough and ready technique should not be condoned. The method for sulphur in copper on page 291 is said to be accurate but this claim is unlikely to be justified because the barium sulphate is precipitated in the presence of large amounts of copper salts. On page 46, it is quite rightly stated that the ignition of $Al(OH)_3$ to $Al_2O_3$ should be carried out at 1,100 to 1,200 deg. C. to ensure the formation of non-hygroscopic $Al_2O_3$. Notwithstanding this, readers are told on page 370, in the determination of aluminium in copper, that the residue should, after burning-off at low heat, be ignited "for 15 min. at the maximum temperature of the muffle (about 1,000 deg. C.)." This would be insufficient to ensure accurate results. Incidentally this method is also unsatisfactory because aluminium and iron are determined together and the aluminium obtained by difference from a previously determined iron content. The use of a mercury-cathode separation would enable the aluminium to be evaluated direct.

It was a happy thought of the authors to include information as to the sources of suitable standards for the elements but there seems to be a lack of appreciation of the full use of standards, for in a number of cases it is stated that they are not necessary because gravimetric procedures are employed. Apart from their use in evaluating colorimetric methods and for volumetric solutions, standards should be used whenever possible with all types of determinations to ensure that all is well with the procedure and the manipulation.

In a book of this size it is almost inevitable that misprints should occur but most of these are of a minor nature and will be readily spotted. It is, however, more serious when one finds three different factors given for the conversion of alumina into aluminium. On page 383 the figure is quoted as 0·5921, on page 370 it is 0·5303, whilst in other places the correct figure of 0.5291 appears. On page 586, a diagrammatic sketch of the "Spekker" is given but the description in the text does not tally with this as it refers to an earlier model of the instrument. Again the plate showing the Cambridge Polarograph states clearly that the dropping mercury electrode is not shown but the text on the opposite page (593) says that it does.

Finally it must be stated that the index is not without mistakes. Of a sample of 27 references sought, the pagination of three were in error and in a fourth what is described in the text as a qualitative test is here called a determination. This is a book in which there is a wealth of excellent information. It is a great improvement on the first edition and had a little more care been taken, it might well have been an outstanding contribution to the literature of metallurgical analysis. In spite of the shortcomings mentioned, it has much to recommend it to chemists.

J. B. P.

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MR. IAN T. MORROW, deputy managing director of the Brush Group, Limited, and MR. G. NICHOLSON, secretary of Blythe Colour Works, Limited, have been installed as vice-presidents of the Institute of Cost and Works Accountants.

# New Equipment

**Straddle Carrier Truck**

British Straddle Carrier Company, Limited, of 7, Chesterfield Gardens, London, W.1, announce the introduction of the "Steelmaster" straddle carrier truck for the iron, steel and heavy industries (shown in Fig. 1). This model, claimed to be the only one of its type produced in the Sterling area, is available with eight alternative dimensions of load aperture, and is capable of handling and transporting loads of 40-ft. or more in length, and up to 10 tons in weight.

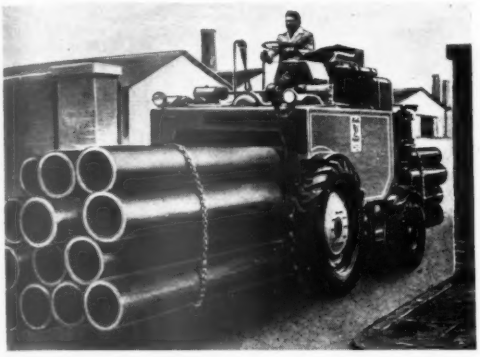


FIG. 1.—*"Steelmaster" straddle truck carrying a load of pipes.*

A recent series of tests has established that the "Steelmaster" can pick up a load of 7½ tons of steel, average length 23 ft., transport it 220 yards over a rough concrete surface, deposit its load and return to the starting point for the next load, in an average time of 78⅘ sec. for the double journey. On this basis it would be possible to move more than 300 tons per hour over 220 yards, with one straddle carrier operated by one man. No tying or securing of the load was necessary, two ordinary wooden "dunnage strips" being used.

The unit is powered by a Perkins P.6 Diesel engine, developing 65 b.h.p. at 200 r.p.m., thus ensuring high power but low fuel consumption and maintenance costs, with a road speed of 25 m.p.h. forwards or in reverse. The oversize tyres of the large diameter driving wheels give great tractive strength, enabling the carrier to cover very rough ground without risk to the load; yet the inside turning radius is only 9 ft. Radio-telephone equipment can be fitted to provide immediate contact between the transport executive and his drivers.

**Crack-detector**

The Magnetic Equipment Company, Limited, of Lake Works, Portchester, Hants, England, announce a new portable magnetic crack-detector, type M.C.J., having a number of interesting applications. Its use depends on the fact that if a crack or flaw exists in a component of magnetic material, however minute it is, then a magnetic field applied across the part will be distorted adjacent to the defect, due to the difference in magnetic permeability between the magnetic material and the flaw. If the magnetic field is passed across the flaw substantially at right angles, then the distortion will be at a maximum. The defects are shown up by applying ink containing minute magnetic particles which adhere to the flaws, revealing them clearly.

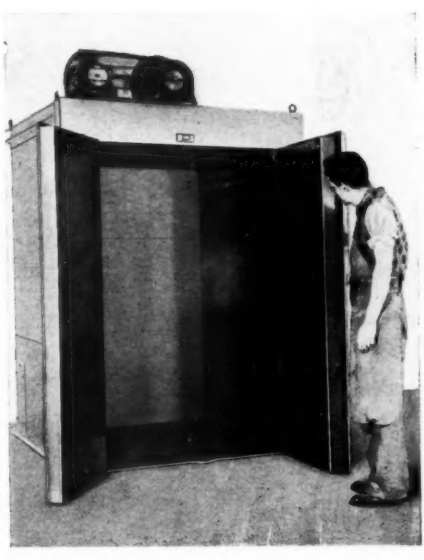
The detection of flaws in any direction requires the applying of the magnetic flux in both directions. On a mass-production machine, this is done by applying magnetic flux by a magnetizing unit and then passing a heavy current through the work which provides the flux at right angles to the first, a somewhat expensive matter. The older type-MCA unit allows this double testing to be done by using prods fitted to flexible leads to pass a heavy current through the work. In many instances this has proved most inconvenient due to the difficulty of getting at the work especially when high up or where access is limited. For these jobs, the type-MCJ unit with its very light control box forms a suitable combination and the provision of the adjustable legs on the magnetizing magnet enables practically any shape of work to be inspected, whether it is a small component, a large fabricated unit or a big casting which it is impossible to take to the machine.

The control box provides complete regulation of the magnetizing current according to the section of the work being handled and it is available for either a.c. or d.c. supplies. Frequently, when considerable outside work is done, the "Universal" unit permitting connection to a.c. or d.c. mains, gives the widest possible application.

**Electric Oven**

A new electric oven (Fig. 2) made to stand on a heat-insulated floor for charging at floor level has been designed by the General Electric Company, Limited, Magnet House, Kingsway, London, W.C.2. The design facilitates charging by the use of bogies which can be moved directly into the oven. By using two or more bogies the oven can be kept in continuous operation. To minimize heat losses through the walls, the oven has a double-cased construction,

FIG. 2.—*G.E.C. oven, designed for charging at floor level.*



*New Equipment*

the space between inner and outer casing being packed with a high-grade refactory. Tubular heating elements are arranged in the oven walls behind baffles. A fan in the roof provides vertical, forced-air circulation down over the elements and up through the oven. This increases the rate of heat transfer to the charge and the overall efficiency, the forced draught equalizing the temperature distribution and reducing temperature gradients in the oven to a minimum.

The oven can be supplied in a wide range of sizes to operate at temperatures up to 250 deg. C. An oven with internal dimensions of 5 ft 8 in. high by 3 ft. by 3 ft. will probably have a rating of about 16 kw., the exact loading depending upon the nature of the charge and the permissible heating time.

## Training School for Draughtsmen

The management of the Fraser & Chalmers Engineering Works, Erith, of the General Electric Company, Limited, being alive to a shortage of draughtsmen, have developed a plan to deal with the matter. Likely candidates whose inclination lie in that direction are given the opportunity to begin their drawing office training earlier than would normally be the case. Towards the end of their five years' apprenticeship they are transferred to a drawing-office training school which has been instituted to give a thorough grounding in the subject. Aspiring draughtsmen attend the training school for a period of six months during which they receive carefully graduated instruction in the fundamentals of their craft and the basic principles of drawing-office technique. As the student gradually gains experience in the training school he inclines ultimately to one or other of the many different branches of mechanical engineering undertaken at Fraser & Chalmers, and his training is directed accordingly. Still an apprentice, he is required, like all apprentices, to continue his attendance at a technical college. In the machine-shops, two courses are open to the apprentice: to study either for the City and Guilds certificate or for the Ordinary National certificate, and this applies also to those who have become trainee draughtsmen. Normally, the apprentice will have taken his Ordinary National certificate during his first three years of training; once this is gained he may spend the remaining two years studying for the Higher National certificate.

## New Scots Research Laboratory

The £600,000 hydraulics laboratory of the Mechanical Engineering research branch of the Department of Scientific and Industrial Research at East Kilbride should, it is estimated, be completed as a building in September, but equipment and interior arrangements will probably be continued until the beginning of next year. Staff are now being engaged, and it is hoped to have the personnel—scientific and industrial—booked before the end of 1954.

As soon as the hydraulics laboratory is finished, building will commence on two other laboratories in the same area. The number of scientific and industrial employees will probably be increased to 800 in two or three years. The plans for the new buildings have been designed and the construction of the laboratories will be entrusted to the Ministry of Works, which acts for the Government in all building and kindred projects.

## Visit to a Plastics Works

Taking advantage of a long-standing invitation to visit a synthetic-resin concern, to see what degree of co-operation was being accorded by this organization on foundry process development, the writer recently toured the works and laboratories at Oldbury, Worcestershire, of British Industrial Plastics, Limited.

This branch is mainly concerned, on the foundry side, with producing urea-formaldehyde resins for core-bonding and the like, though shell moulds for thin-section castings have also been produced satisfactorily from u.-f.-resin sands. It was impressive to see the manufacture of resins—reminiscent of a visit to a brewery, in that the process, being well-established and almost continuous, seemed to require only maintenance men and chemists. Quite elaborate precautions are taken to ensure uniformity of product and to preserve " case-histories " of each consignment.

### Laboratories

It was in the extensive research laboratories of the firm at Oldbury, however, that the full meaning of the words " co-operation with consumer industries " was really brought home. Here, quite apart from large research and testing blocks engaged on developing new resins and applications therefor, separate laboratories cater for each of several applications, *e.g.*, foundry industry, paper trade, textile trade, mouldings, adhesives, etc. In the " foundry " laboratory is a complete range of sand-preparing and testing equipment, with melting furnaces outside, fully to test the product under proximate working conditions and to develop optimum mixtures of resin and sand. No fewer than 15 varieties of sands are stocked for making up trial compositions. Foundrymen are invited to send representatives to this department to gain experience of the handling of resin-bonded sand.

In this manner, the foundry industry is well served by its supplier industry, and any set-backs in application can be properly investigated. Likewise, newly developed resin-applications can be tried out on a laboratory scale—surely a better way than persuading a busy foundryman to try out a completely " unknown " sample. Resin manufacturers are not content with laboratory tests alone, however, and, following these, large-scale testing in selected foundries is instituted. In fact, while the writer was visiting the firm, a development of their u.-f. resin which would obviate the noxious odour was foreshadowed, and a general announcement on these lines is to be expected in the near future.

## Sheffield University Appeal

Sheffield University has circularized 1,500 industrial undertakings in the area with an appeal in an effort to raise £30,000 a year for its engineering and metallurgical departments. The sum of £30,000 is the annual expenditure in the two departments on wages of staff other than salaries of professors and lecturers, and the cost of supplies and equipment needing regular renewal. A number of firms have already agreed to make an annual payment of £25 for each 100 people employed, including salaried staff.

The appeal letter states, " Much as we desire it, we have little chance, with our present resources, of keeping fully abreast of each new development in technology, nor can we expect to consolidate our considerable reputation for scientific researches. It is therefore particularly important that we seek out new sources of income."

# Metallurgical Research at the National Physical Laboratory

The Report* of the National Physical Laboratory for the year 1953 contains the following account of the work of the Metallurgical Division, contributed by the Superintendent, Dr. N. P. Allen:—

### Introduction

The outstanding event of the year has been the erection of the Metallurgy extension which became ready for the installation of equipment at the end of December. Occupation will begin during the first months of 1954. In April 1953, on the retirement of Mr. Tapsell, the high-temperature mechanical properties section of the laboratory was attached administratively to the Metallurgy Division, the general nature of its work remaining essentially unchanged.

A new type of work has been introduced with the successful operation of the soft X-ray spectrograph. The next year or two should show if this technique has a powerful contribution to make to the study of alloys. A new 50-lb. high-frequency melting furnace has been installed, and will permit the preparation of sufficient quantities of closely controlled alloys to enable their more complex mechanical properties, such as their behaviour under dynamic loading, to be investigated in detail. Very interesting results have been obtained in a comprehensive study of the tensile strength of single crystals of iron over a wide range of temperature.

### Metallurgy Extension

The new metallurgy building occupies a site, approximately 130 × 90 ft., opposite the former engineering building. It has two floors and a total floor area of 11,700 sq. ft., of which 5,800 sq. ft. are experimental working space. The ground floor provides a kiln room and five laboratories and offices for the use of the Refractories Section. The kiln room was formerly the metallurgy division machine shop and was adapted last year. This floor also provides a set of rooms designed for experimental work with radioactive tracers; the main feature is the active foundry, a lofty and well-lit room, in which it will be possible to melt, roll and heat-treat active metals in quantities up to 6 lb. Adjacent to the foundry are a small workshop and laboratory. These three rooms, approached through changing rooms, are so designed as to be easily cleaned, the drains leading to suitable delay tanks. The air is circulated under slightly reduced pressure and purified from active matter before being ejected. Up to 25 changes of air per hour are provided, and an alarm system gives warning of failure of any part of the air circulation system. The precautions make it possible to deal with material of all but the very highest activities. The ground floor includes a metal store and an electrical substation, which serves the metallurgy buildings and a group of adjacent buildings.

The upper floor is designed for X-ray crystallography of metals, electron microscopy and related studies. Except for three offices and one smaller laboratory, it consists of a single large room, amply supplied with services through wall and floor ducts. The space is divided by means of easily removable wooden partitions into a number of cubicles and small laboratories, each having a full range of laboratory services. Each of the cubicles is intended to contain a separate piece of equipment and can be darkened, or by a system of roof lighting each cubicle can receive full daylight no matter how the space is divided. In this way the need of the individual worker to have sole control of his own equipment is combined with adaptability in the use of the space. The equipment of the laboratory will include a wide variety of X-ray tubes, both sealed off and continuously evacuated, as well as fine focus and high power tubes, electron diffraction apparatus, Geiger counter spectrometers, electron microscopes and a soft X-ray spectrograph; the apparatus has been chosen to permit the use of the full range of modern experimental techniques.

### Ferrous Section

The removal of part of the Refractories Section to the new building has made space available in the Metallurgy foundry, and this has been occupied by the new 50-lb. high-frequency vacuum-melting furnace and its motor generator set. There are now two similar motor generator sets, each of which may serve a 75-lb. air melting furnace, a 25-lb. and a 50-lb. vacuum-melting furnace, as well as a small high-frequency induction furnace to be installed in the Chemistry Section as part of an improved equipment for vacuum fusion determinations of gases in metals. Together these provide a modern and flexible melting equipment, with reserve capacity in case of breakdown. These facilities should meet the expected needs of the Division for some years.

The important effects of small quantities of carbon on the mechanical properties of high purity iron, with particular reference to the transition from the tough to the brittle state, have been described in a paper published by the Iron and Steel Institute. The great toughness, with increased yield stress, that can be conferred on iron by retaining as little as 0.04 to 0.05 per cent. of carbon in the ferrite by quenching, is diminished by ageing the metal at room temperature. The ageing effect is accompanied by the precipitation from the supersaturated ferrite of carbon-rich areas readily detected by the electron microscope, and can be substantially prevented by the addition of about 0.75 per cent. of manganese. These results render intelligible the effects of manganese content and heat-treatment

* The Report is available from Her Majesty's Stationery Office and costs 3s. net.

*Metallurgical Research at the National Physical Laboratory*

upon the susceptibility of mild steel plates to brittle fracture and indicate how the susceptibility may be controlled in practice. Nitrogen is often considered to be similar to carbon in its effects on iron, but in the course of a study of an iron containing 0.01 per cent. of nitrogen a number of effects quite different from those of carbon have been found. In particular, the grain boundaries appear to be greatly weakened by the presence of nitrogen in solution in ferrite, and the precipitation of iron nitride appears to be less effective in decreasing the ductility of iron than is the precipitation of iron carbide. The degree to which the grain boundary embrittlement occurs is strongly influenced by the rate of cooling through certain ranges of temperature.

Phosphorus has long been known to reduce the ductility of iron. Its effects prove to be in many ways similar to those of nitrogen. Grain boundary embrittlement is produced, to a degree that depends upon the quantity of phosphorus and the rate of cooling. The influences of heat-treatment upon the phenomena produced by phosphorus and nitrogen are being worked out and compared in detail.

Further studies of the effect of phosphorus on the properties of heat-treated high tensile alloy steels continue to show that the necessary standards of strength and toughness can be secured with the use of less alloying elements when the phosphorus content of the steel is low. Although the supplying of alloying elements is now much better than it was when this work was begun, the work will be completed in such a way as to establish beyond doubt the accuracy of the principle.

The successful production of single crystals of high purity iron has enabled a study to be made of their behaviour in tension over a range of temperature extending from 100 to −253 deg. C. At the boiling point of liquid nitrogen, −196 deg. C., the orientation of the crystal with regard to the stress axis is of the greatest importance in determining its behaviour. If the (100) cleavage plane lies at an angle of more than about 65 deg. to the tensile stress axis, the crystal cleaves with little prior deformation. If the angle is between 45 deg. and 35 deg. the crystal behaves in a perfectly ductile manner, drawing down to a chisel edge before breaking. At intermediate orientations the crystal may first deform by twinning and then slip, exhibiting considerable ductility, but finally breaking with a cleavage fracture. A few crystals have been tested at −253 deg. C., and broke with cleavage fracture with little or no prior deformation. It is of great interest to record that the cleavage strength at −253 deg. C. is about 30 per cent. greater than at −196 deg. C., thus demonstrating a strong temperature dependence. The temperature dependence of cleavage strength has hitherto usually been assumed to be small or zero. The slip planes have been identified as (110), (112), and (123). Clearly marked slip planes are observed in the early stages of deformation, and are succeeded in the later stages by the "wavy" slip more commonly seen in iron.

**High-temperature Materials**

The principal task in connection with high-temperature materials has been the determination of the safe working temperatures for the critical materials in the steam power plants now under construction for operation at a steam temperature of 1,050 deg. F. The materials include chromium, molybdenum and molybdenum-vanadium ferritic steels, austenitic creep-resisting steels and a variety of high temperature bolt steels. The expected life of the power plants is from 100,000 to 150,000 hours, and in order to arrive at the working data long period creep and relaxation tests, of up to 30,000 hours' duration, are being made. Most of the materials have now been tested for 10,000 hours, and a preliminary estimate of their performance can in some cases be attempted, but confirmatory tests and the examination of minor points that have arisen will occupy considerable time. Examination of the relaxation behaviour of bolts after repeated retightening, and of the high temperature strength of welds made in tube and pipe materials, is intended. The tests have been generally reassuring, in that the properties of typical components in the condition in which they will go into service have proved to be reasonably uniform, and not appreciably different from those of previously tested sample bars of steels of types that have been used. Up to the present, the austenitic steel shows better load carrying capacity at 600-650 deg. C. than does the molybdenum-vanadium steel.

Consideration is being given to the metallurgical problems that will arise as steam temperatures are increased in steps to 1,200 deg. F. Since it was expected that increasing use will be made of chromium-rich ferritic steels, an examination of the factors influencing the creep resistance of such steels was begun last year. The work has shown the important influence that can be exerted by additions of titanium and niobium when the heat-treatment is such that carbides dissolved in the metal at high temperature are precipitated in highly dispersed forms at or near the working temperature. The changes in these alloys and their effects on creep resistance and resistance to fracture will be systematically examined next year.

A paper on the influence of aluminium and of various heat-treatments on the creep properties of low-carbon superheater tubes has been published. The work undertaken for the study of cracking in steam pipes has been concluded. No experimental work on the corrosion of steel in steam at high pressure has been undertaken in the past year, but a report summarizing the long time tests at 550 to 650 deg. C. has been considered by the supervising committee appointed by the Electrical Research Association, and a paper is being prepared for publication. The apparatus is being maintained for future requirements. A paper is being prepared on some metallurgical features of molybdenum steels, and the effects upon them of vanadium, chromium and other elements.

In the field of the gas turbine, the study of blade and disc materials has continued. The main part of the work on existing materials at temperatures

up to 1,000 deg. C. has been concluded. Tests have been started on a chromium-cobalt-tantalum alloy at 900 deg. C. Work on the effect of vanadium compounds in the ash from residual fuel oil has continued, and the results show that "protective" coatings are, in general, of little value, although some protection is afforded to iron-base alloys by a "chromizing" treatment.

Tests at the temperatures reached in gas turbine compressors have been made on a titanium-rich alloy containing 4 to 5 per cent. of aluminium. Excellent creep and fatigue properties at temperatures up to 400 deg. C. have been demonstrated.

Considerable progress has been made in the development of methods for carrying out creep tests at very high temperatures. The creep properties of metal/metal oxide bodies at temperatures up to 1,200 deg. C. have been examined, and an extensometer has been made for measuring creep at 1,400 deg. C.

Fundamental studies of creep processes have been concerned mainly with aluminium and its alloys, and methods for extending the work to copper and austenitic heat-resisting steel have been studied during the year. Experiments on pure aluminium have been extended to 500 deg. C. ,and it has been found that the proportion of the total deformation due to grain boundary sliding increases with rising temperature up to 300 deg. C., and then remains constant. The creep at 200 deg. C. of solid solutions of zinc, copper and magnesium in aluminium has been investigated. The essential processes are the same as in pure aluminium but slip-bands are less prominent when solute atoms are present. Copper and magnesium additions increased the creep resistance of aluminium, whereas additions of zinc decreased it.

In the investigation of the fatigue strength of materials at high temperatures, most attention has been given to the effect of cyclic speed on copper at temperatures up to 350 deg. C. and on 80/20 nickel-chromium alloy at 750 to 850 deg. C. Both materials show a small reduction in fatigue strength at the lower speeds of test.

An attempt has also been made to correlate the sensitivity of mild steel to fatigue at stress concentrations with the shape of the dynamic stress/strain curve. A certain amount of success has been obtained in relating to the calculated stress concentrations the stress at which a notched or drilled testpiece fails but the results suggest that other factors must be taken ino consideration.

During the year, a fresh interest has been aroused in the changes that lead to the initiation of a fatigue crack. Attempts have been made to detect the first appearance of a crack in mild steel by means of tensile tests at liquid air temperature, and methods are being worked out for studying the disorientation in the highly strained areas by observing the local diffusion rates. These experiments are at a too early stage for their promise to be assessed.

### Titanium

A paper on the free energy of titanium-oxygen alloys has been published, and preliminary measurements on zirconium-oxygen alloys have been made. The causes of the difficulty of removing calcium and magnesium oxides from titanium reduced directly from titanium dioxide have been investigated, and titanium metal of much improved purity has been produced.

Reductions of titanium dioxide with mixture of alkaline earth, metal chlorides and alkali metals have been examined. Reactions of the type

$$TiO_2 + 2CaCl_2 + 4KTi + 2CaO + 4KCl$$

appear to be possible according to thermochemical calculations, but in practice have not yielded metal of satisfactory purity.

Useful improvements have been made in the techniques of temperature measurement in the course of constitutional work at high temperatures on titanium alloys. A new determination of the melting point of titanium has been made and the result published. The error, estimated to be within $\pm 10$ deg. C., is appreciably less than that of previous determinations and the melting point of pure titanium has now been found to be 1,660 deg. C., that is 20 to 60 deg. C. lower than the previously accepted figures. Methods have also been developed for quenching specimens at closely controlled temperatures around 1,700 deg. C., and for determining the liquidus and solidus temperatures of alloys.

These methods are being applied to the accurate determination of the equilibrium diagram of titanium-oxygen alloys. Meanwhile, a partial study of the constitution of titanium-iron-oxygen alloys, confined to temperatures below 1,100 deg. C., has been submitted for publication, and a similar partial study of the constitution of titanium-aluminium-oxygen alloys has been started.

A new arc melting furnace has been constructed. With it as many as ten ingots having a variety of compositions can be melted in a single operation, so that preparation of a series of alloys is greatly facilitated. The equipment was intended for work on titanium but has also been used for melting uranium alloys, molybdenum and niobium.

A preliminary survey has been made of the $\gamma$-phase field and neighbouring fields of the titanium-aluminium-vanadium system. The $\gamma$-phase of the titanium-aluminium system is of special interest because of its outstandingly high elastic constants, but it is brittle. When vanadium replaces aluminium in this phase, the brittleness is somewhat decreased. The heat of formation of the binary $\gamma$-phase alloy has been found by calorimetric work to be about 11k cal. per gramme-atom, and to be considerably decreased when vanadium replaces aluminium. X-ray patterns show at the same time a decrease of the departure from cubic symmetry of the tetragonal $\gamma$-phase structure. These results suggest that when vanadium replaces aluminium there is an increase in truly metallic characteristics.

### Other Non-ferrous Metals

A paper on the strength at high temperatures of molybdenum and its alloys has been accepted for publication, and this work is now concluded. Work on the constitution of magnesium-zinc-zirconium alloys has been completed and reported.

Some years ago an investigation was started in

*Metallurgical Research at the National Physical Laboratory*

co-operation with R.A.E., Farnborough, whereby a series of magnesium alloys with closely controlled small additions of iron content were rolled at N.P.L. and their resistance to corrosion was tested at Farnborough. The results of this investigation have now been published in a joint paper which shows that high corrosion resistance was shown by the magnesium-aluminium-zinc alloy only when it was of high purity, whereas the magnesium-manganese alloy had high corrosion resistance irrespective of its iron content.

A new investigation on the stress corrosion of magnesium-7 per cent. aluminium alloys has been initiated. These alloys have good mechanical strength but are susceptible to stress corrosion and, since there is still a need for a reliable strong magnesium-base sheet alloy suitable for aircraft, the fundamental causes of the stress corrosion phenomenon in these alloys are to be re-examined, in the hope that some way of overcoming the difficulty may be suggested.

Work on the equilibrium diagrams of uranium alloys has been continued on behalf of the Directorate of Atomic Energy. A paper on the uranium-nickel system has been published.

**Refractories Section**

The new recuperative gas-fired kiln has fulfilled expectations. A smaller gas furnace of a new design has been constructed and is proving to be very useful. Pure alumina crucibles of considerable size have been successfully made for use with the new 50-lb. vacuum melting furnace. The results of a new measurement of the density of molten iron have been published. The method is simple, involving the construction of a suitably designed pyknometer in pure sintered alumina. The results are closely reproducible and the method could be applied to a wide range of molten alloys.

A new investigation of the physical properties of refractory materials at high temperature, suitable for use in rocket nozzles, has been undertaken on behalf of the Ministry of Supply. Apparatus for measuring the tensile strength of such materials above 1,700 deg. C. is under construction.

**Minor Investigations and Test Work**

Thirty-nine tests by fee have been made, and 53 British Standardized samples of steel have been sold.

The examination of a pair of 17th century scissors on behalf of the Ministry of Works Ancient Monuments Laboratory proved to be of interest on account of the great skill that had been used in heat-treating blades composed of a hard steel cutting edge welded to a mild steel backing. Amongst other subjects given attention, were the deterioration of blades in gas turbines fired with peat, the loss of strength in pre-stressed reinforced concrete beams exposed to fire, and the properties of hard metals for use as drill bits.

The practice of using the metallurgy foundry to produce castings for the construction of apparatus in the laboratory has grown considerably during the year. This saves much time and is very convenient so long as the essential work of the foundry is not interrupted.

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## B.I.S.R.A. Activities

The opening by H.R.H. the Duke of Edinburgh of the new B.I.S.R.A. Research Laboratories in Sheffield formed a major event of 1953, states the Council of the British Iron and Steel Research Association in presenting the 10th annual report for the year ended December 31. The extra research facilities at Sheffield, coupled with the added cost of the upkeep of the laboratories make it increasingly difficult to contain the Association's expenditure within the bounds of its income and at the same time to continue to set aside a small sum towards reserves for future developments. Total expenditure by the Association (excluding the cost of the new Sheffield laboratories opened in November) was £467,000; rather more than in 1952.

Apart from the 200 or so projects in the current research programme, there are many others that could be started if sufficient funds were available, it is stated. In particular, there is a need to intensify research on design of steelworks plant as it is felt that industry has, for too long, been dependent upon American design. The Association has benefited from the sterling counterpart of funds allotted under the provisions of the Mutual Security Act and grants totalling £25,700 spread over three years have been approved for investigations on productivity in the steel industry, improvement of control design, organization of the flow of technical information into and within the industry, and advisory services.

## House Organs

**Modern Foundry,** No. 1 (18th year of publication), 1954. Published for the Gibson Engineering (Sales) Pty., Limited, Redfern, Sydney, Australia.

The bulk of this issue is taken up with a description of the "D" process. This has been taken up by Mr. Wm. A. Gibson, who has, for many years, been the representative in Australia for the Harry W. Dietert Company of Detroit.

**Bowater Papers, No. 3, 1954.** Published by the Bowater Paper Corporation, Bowater House, Stratton Street, London.

This house organ is equal, if not superior, to the best American trade publication. The layout, colour work and typesetting if of a very high order. As it has nothing to do with foundries the reviewer will content himself with these commendations.

**One and All**—Winter 1953-4. A quarterly review for agents; published by Tangyes Limited, Cornwall Works, Smethwick Birmingham.

This issue contains a summary of a paper on exothermic feeding heads read by Mr. J. Grice, the firm's joint foundry manager to the Birmingham branch of the Institute of British Foundrymen. A second article speaks appreciatively of the work of the British Cast Iron Research Association.

**Newsletter,** May 1954, Vol. 6, No. 5. Published by the David Brown Group.

The Editor of this magazine has indeed a difficult task as the Group has works scattered throughout the country, plus overseas organizations. He has, however, one general theme to publicize and that is the exploits of the racing cars which the Group manufactures. Moreover he does this particularly well, while still covering very adequately the major current events in the history of the Group.

## Iron-ore Imports

Iron-ore imports in April and the total for the first four months of this year compared with the corresponding period of 1953 are shown below.

| Country of origin. | Month ended April 30. | Four months ended April 30. | |
|---|---|---|---|
| | 1954. | 1954. | 1953. |
| | Tons. | Tons. | Tons. |
| Sierra Leone .. .. .. | 34,350 | 196,558 | 262,148 |
| Canada .. .. .. .. | 10,170 | 150,081 | 133,587 |
| Other Commonwealth countries and Eire .. .. .. | 1,331 | 15,008 | 16,254 |
| Sweden .. .. .. .. | 384,415 | 1,384,056 | 1,042,687 |
| France .. .. .. .. | 42,601 | 166,202 | 170,170 |
| Spain .. .. .. .. | 51,119 | 167,678 | 162,806 |
| Algeria .. .. .. .. | 212,283 | 715,326 | 537,651 |
| Tunis .. .. .. .. | 50,880 | 174,196 | 154,923 |
| French Morocco .. .. .. | 16,300 | 102,457 | 76,033 |
| Spanish Morocco .. .. .. | 15,500 | 82,657 | 102,577 |
| Liberia .. .. .. .. | 26,900 | 71,859 | 123,728 |
| Brazil .. .. .. .. | 47,532 | 146,780 | 68,946 |
| Other foreign countries .. .. | 89,767 | 318,214 | 130,903 |
| TOTAL .. .. .. .. | 983,148 | 3,691,072 | 2,982,413 |

W. G. BAGNALL LIMITED, of Stafford, have received an order from the New Zealand Government for ten Diesel, mechanical shunting locomotives.

## Halifax Accident Report

At Halifax Borough Court, last month, a fine of £50 was imposed on William Asquith, Limited, machine-tool makers, Halifax, for failing to comply with factory safety regulations. The case arose from the death of a painter, D. V. John, who was struck by one of the firm's 17 mobile cranes, knocked off a girder high above the machines in Highroadwell works, and fell to his death. Mr. Harry Ludlam, pleading "guilty" on behalf of the firm, stated that John, employed by a firm of painters, sub-contracted to paint the roof and interior of the works, was a stranger within, lacking knowledge of the premises and the movement of cranes. In reply to an allegation that there were no safety measures whatever instituted for the painters, Mr. Ludlam said he understood that the painters were to be withdrawn each time a crane was moved, but at the time of the accident the sub-contractors' foreman, who was keeping an eye on the painters, was carrying out duties elsewhere. As John was only sweeping the girders and not actually painting, there was no new paint visible to give a warning to the crane driver. Mr. J. A. Davis, factory inspector, contended that nothing had been done by way of safety arrangements in the shop. There was painting near the cranes which could have been done at night, or at the week-end, and he suggested that the extraneous noises from the floor might have been so great that John failed to appreciate the crane's approach until it was too late.

## Scots Light Casting Industry

There was cold comfort in the reply which Mr. Malcolm MacPherson received from the Parliamentary Secretary to the Ministry of Supply, when he asked about the decline in orders experienced by the iron-founding industry in the Falkirk area. Mr. A. R. W. Low stated that foundries in the Falkirk-Bonnybridge area will continue to be invited to tender for M.o.S. orders as occasion arises. He added, however, that orders on the ironfounding industry are not likely to be as large in the future as they have been in the past three years. Mr. MacPherson, who has been a staunch fighter in Parliament for the industry, cannot have been satisfied with such a reply, and no doubt he will continue to press the Government for a share of defence programme orders for the foundries.

Defence orders, alone, however, cannot suffice. What is needed is a revival in the home demand for the wide range of castings which the foundries produce, and that can largely be brought about by an intensification of the housing programme in the country and decisions to provide improved housing standards. It may be argued that such improvements are not economically possible at the present time, but as conditions better, a return to pre-war housing standards should be demanded. Much also could be done to help the ironfounding industry by a progressive policy of modernization of old housing property.

**Conference Fund**

In addition to subscriptions to the Glasgow conference fund of the Institute of British Foundrymen, published in the March 18 issue of the JOURNAL, the following donations have been received:—

John Cameron, Senr. ... ... ... £25
Stewarts and Lloyds, Limited ... ... £100

The grand total of subscriptions to the fund now amounts to £4.242 19s.

## "Blowing our Own Trumpet"

On every possible occasion, Britain should blow its national trumpet—hard. This was the theme expressed by Sir Leslie Gamage, vice-chairman and joint managing director of the General Electric Company, Limited, in an address to the Advertising Association conference at Bournemouth. Sir Leslie deplored the British characteristic of understatement, which, he said, let us down in the face of a world that was painfully ignorant of the real state of affairs in this country. We had had some very faulty ambassadors in the years immediately following the war—men who were dissatisfied with the administration at home and were only too ready to grumble to those they met overseas. He had even heard Ministers of the Crown in public speeches announcing to the world that British quality was frequently faulty. Such stories of decline were always eagerly exploited by our competitors, and it was up to advertising to dispel some of the illusions held by other nations. In the export market, national prestige and goodwill were of prime importance.

One great slander overseas, continued Sir Leslie, was that Britain's wage-earners were working too few hours. In 1952 the average weekly hours of work in the U.K. was 45.6; in the U.S. they were 40.5. The index of output per head in industry and manufacture (1938 = 100) in the U.K. for 1951 was 129, in the U.S. 120, and in France, 122. The only country in the world that beat Britain was Sweden, with a figure of 131, but Sweden had had no war. Such news as this should be disseminated in the outside world.

## Rolls-Royce Statement

A statement by the management of the Rolls-Royce jet-engine factory at East Kilbride has allayed fears of unemployment arising from a set-back in the aircraft production programme. Mr. A. W. Vickers, factory manager, stated that when work picked up again the number of employees required would be quite substantial. For approximately the next six months, however, they would have difficulty in finding enough work for all employees in their present jobs. Production of the factory was affected not only by the curtailment of the aircraft programme, but also by the hold-up in the construction of engines for the "Comet."

Although there will be a switch round of labour in certain departments to handle specific jobs, and to ensure work for all, the heavy commitments next year will necessitate an increase in the labour force. The firm felt that this assurance was necessary in case skilled men, concerned about their future prospects, might look for work elsewhere.

### Inspection Code

The Association of Bronze & Brass Founders, from 69, Harborne Road, Edgbaston, Birmingham, 15, announce that the *Code of Procedure* to facilitate the co-ordination of inspection for copper-base alloy castings ordered by the Ministry of Supply is now in the hands of the printers. Orders are now invited for copies of the code, which will be supplied on the following basis:—Members—3s. 6d. per copy (orders of 50 or more 2s. 6d. per copy); non-members—5s. per copy (all carriage paid). The code is comprehensive and will cover contracts placed by all branches of the Ministry of Supply; it will therefore have wide application and brassfounders are urged fully to cover their ultimate needs, so as to avoid possible disappointment at a later date.

## Hayward-Tyler Extensions

When the Edinburgh section of Hayward-Tylor & Company, Limited, moves to East Kilbride in the autumn it will take with it 70 of its employees who have been with the firm since they went to the Marine Gardens, Portobello, in 1946. At East Kilbride the firm will have 60,000 sq. ft. of factory space—twice as much as it had in Edinburgh—for the manufacture of turbines for oil refinery work, pumps for ships, and machinery for the mineral-water bottling trade.

"We have a big programme of expansion schedules for the next two years," said Colonel A. C. Ball, works manager. "We will be expanding carefully but not slowly." In five years time it was visualized that the firm would have up to 300 on the payroll at its Scottish factory.

The firm's headquarters are at Luton (Beds.). They were directed to Edinburgh in 1946 by the Board of Trade, but they have been unable to get a "secure lease" of the premises. "If we had got over that difficulty we would have been very pleased to remain here," said Colonel Ball. "We feel something could have been done by the local authorities to keep the industry at Portobello. At East Kilbride, Hayward-Tyler's have a 21-year lease.

## Sequel to Crane Collision

A verdict of "accidental death" was returned last month on Wilfred Perkins, a 31-year-old electrician's mate who, as previously reported, fell from a 10-ton overhead crane at the works of Samuel Fox & Company, Limited, Stocksbridge, Sheffield. The jury said that they had been worried to learn that the crane was operated without an alternative braking system. Mr. J. Pearson, who was driving the crane, said the control jammed halfway as they approached a 100-ton crane. He switched off the current, but the crane continued forward on its impetus, though slowing down. It bumped into the other crane and he saw something fall. He said the foot-brake had not operated for some time but he had not complained, as he was a maintenance man and not a driver. The deputy-Coroner, Mr. A. W. Lambert, said the sole cause of the crane not being braked was a broken nut and spring. "I should have thought someone would have taken supreme control and responsibility for the maintenance of this machine, but it seems to me that there must be a sharp dividing line between the electrical and mechanical sides."

## Institute of General Managers

At the first Midlands dinner of the recently-formed Institute of General Managers, in Birmingham, last month, Dr. R. S. Aitken, vice-chancellor of Birmingham University, urged a closer contact between industry and the university, with executive managers spending six months or a year learning with young university people. Mr. A. G. B. Owen, chairman and joint managing director of Rubery Owen & Company, Limited, said the mistake made in the past of treating youth as cheap labour must not be repeated. They must be given the opportunity for education and training. Neither could the aged be neglected; it was ever becoming more necessary not to pension off men at 65 and women at 60. Other speakers at the dinner included Mr. William Blackwell, president of the National Union of Manufacturers, Midland area; Mr. P. A. M. Gell, a member of the Council of the Institute of General Managers; Mr. H. E. Branton Brightley, who presided; and the Lord Mayor of Birmingham, Ald. G. H. W. Griffith.

## B.C.I.R.A. Continental Visit

The first post-war visit, organized by the British Cast Iron Research Association, of representatives of member-firms to Europe took place in May, the total number participating approaching 60. Two parties were arranged, making use of weekends for travelling to and from the Continent, so that each visit could be confined to one working week, during which 10 foundries were seen, in addition to other visits arranged for small groups. The tour centred around installations of the hot-blast cupola, every commercially available form of which, with one exception, was inspected. The warmest thanks of the Association and of the participants are due to these firms for permitting the visits and for their hospitality. As both parties followed the same route and saw the same plants, one general account will suffice.

The opening visit was to the large Cockerill foundry at Seraing, Liège, followed by one to the C. G. des Conduites d'Eau, Les Vennes, Liège, where two metallurgical-blast cupolas, the larger having 10 tons per hour capacity, are normally in operation. The parties then proceeded to Germany. The first plant seen here was the well-known Goetzewerke at Burscheid, makers of single-cast and centrifugally-cast piston rings. This illustrated a hot-blast furnace fitted with the Schack type of recuperator. The next visit was to the Economiser Werke at Hilden, showing the firm's own (V.E.W.) design; after this visit the parties dined with the company. On the third day the parties divided, one to the malleable foundry of Engels and Wenke, Velbert, and the other to the Steinmüller works at Gummersbach, the latter showing the first installation of the Strikfeldt design of hot-blast cupola, fitted with Steinmüller recuperators, and the former the latest type of the same design, similarly fitted. The groups rejoined in the afternoon at the Bergische Stahl-Industrie, Remscheid, and later dined as guests of the company at Schloss Burg. This company has a V.E.W. installation and also a cupola with a Schack spiral recuperator. The remaining visits were to plants of the Buderus group, the first at Staffel, the second at Wetzlar, having hot-blast furnaces of the Strikfeldt design, yielding 2.5 and 25 tons per hour respectively, and finally to the Lollar plant having a hot-blast cupola of the same design, feeding what is probably the most advanced mechanized production track in the world, in this case for radiator sections. This plant created a great impression. At Wetzlar and neighbourhood, the parties were the guests of the Buderus Company for luncheon and dinner.

### New Experimental Station

On Friday, May 14, Professor H. Jungbluth of Karlsruhe after dinner outlined to the first party the theoretical approach to the work of a new experimental station for the study of hot-blast cupola development now being established at the Wetzlar works of Buderus, to be operated in conjunction with Strikfeldt and Company. An engineer of this company then showed plans of the station and the plant to be incorporated therein. On May 21, the second party heard a similar statement from Professor Jungbluth, this time in English, followed again by an account of the plant now being installed. These announcements were the first public statements to be made about this development. The latter gathering took the form of a dinner of welcome offered by the *Verein Deutscher Giessereifachleute*, the president of which, Herr. Küster, was in the chair, accompanied by the vice-president, director Paul Schiegries of Hilden, and the chairman of Council, Dr. G. Schwietzke. Others present included Dr. F. Grabowski, managing director, and Dr. F. Grosser, technical director of the Buderus group, Professor Jungbluth, Dr. W. Patterson of the *Technical Hochschule*, Aachen, representing the German foundry trade association, *Wirtschaftsverband-Giessereiindustries*, director Otto Mattern, and dipl.-ing. O. Hornung. Herr. Küster welcomed the visitors on behalf of the V.D.G. and Dr. Pearce suitably responded.

Both visits were completed throughout in accordance with the pre-arranged schedule and by general consent were considered, though arduous, to be highly successful. The details of the travelling arrangements were made by Leslie Ling's Private Tours, Limited, of London, and the warmest thanks of the Association and the visitors are recorded to M. Jacques Foulon of Brussels, director of the *Association Technique de Fonderie de Belgique*, for great assistance with respect to the Belgian visits, and to Mr. W. Strikfeldt of Gummersbach for great help in the arrangement for the German visits and for the untiring assistance of his staff.

## *Company News*

MATHER & PLATT, LIMITED—It is reported that the directors propose issuing 1,363,660 ordinary £1 shares in a two-for-three scrip issue.

PETER BROTHERHOOD, LIMITED, engineers and iron-founders, of Peterborough—An increased interim dividend of 8 per cent. has been declared in respect of the year to March 31, 1954. For 1952-53 an interim of 5 per cent. was paid, followed by a final of 13 per cent., to make a total of 18 per cent.

AITON & COMPANY, LIMITED, pipework manufacturers and engineers, of Derby—Arrangements are being made to market the 10s. ordinary shares. The ordinary capital, for which a quotation is now being sought, is £250,000 in 10s. shares on which a 17½ per cent. dividend for the year to March 31, 1954, has just been announced.

WESTINGHOUSE BRAKE & SIGNAL COMPANY, LIMITED—In conjunction with Bellamy & Lambie (Pty), Limited, Johannesburg, which has been acting as the company's agents in South Africa for a number of years, a new company has been formed under the title of Westinghouse Brake & Signal Company S.A. (Pty), Limited, to manufacture certain items of railway, road, and mining equipment. The directors of the new company are Mr. A. R. Walwyn, managing director of Bellamy & Lambie (Pty), Mr. N. V. Davies, Mr. J. Pryce, and Mr. M. W. Shorter, managing director of Westinghouse Brake & Signal Company in England.

R. & W. HAWTHORN, LESLIE & COMPANY, LIMITED—The Capital Issues Committee has agreed to the issue of 358,275 5 per cent. cumulative preference £1 shares and 895,687 ordinary 10s. shares by way of capitalization of reserves. These issues will be in the proportion of one preference for every five ordinary 10s. units held, and one ordinary 10s. share for every two ordinary 10s. units held by ordinary holders registered at June 30. The directors also propose to form, at an early date, two subsidiaries to which will be transferred the operating activities of the shipbuilding yard and of the engineering works. The consideration will consist of shares in such subsidiaries which will be wholly owned by the present company. The above arrangements are subject to sanction of stockholders and the necessary meetings for this purpose will be convened at an early date.

## Personal

REFINED IRON COMPANY (DARWEN), LIMITED announce that MR. W. F. COOKSON, L.I.M., A.M.I.I.A., has joined the technical staff, with effect from June 1.

MR. R. D. COOPER, managing director of Albert Jagger, Limited, motor-body fitting manufacturers, of Walsall (Staffs), has been elected the first Mayor of Solihull, Birmingham.

MR. J. MACKENZIE, of Mackenzie & Moncur, Limited, Edinburgh, has been elected president of the Association of Heating, Ventilating, and Domestic Engineering Employers.

WING COMMANDER J. M. AITON, chairman and managing director of Aiton and Company, Limited, pipework engineers, of Stores Road, Derby, has arrived in Australia on a business mission.

MR. THOMAS PATRICK SPENS, chief buyer for Stewarts and Lloyds, Limited, at Corby (Northants), is one of the new Justices of the Peace for Northamptonshire and will sit on the Little Bowden Bench.

MR. J. F. WHITFIELD has been appointed chief engineer of Round Oak Steel Works, Limited, Brierley Hill (Staffs). He was formerly with B. Thornton, Limited, iron, steel, gas, and chemical works equipment makers, of Huddersfield.

ON JUNE 9, MR. THOMAS BUNN, director of Hill Top Foundry Company, Limited, Wednesbury, completed his fortieth year of service with the company, thus making a total of 200 years in direct line of four generations of the Bunn family in the service of the company.*

MR. J. IVAN YATES, director of Radiation, Limited, who is in charge of the company's production at Birmingham, of gas- and solid- fuel-fired domestic appliances, has been elected president of the Birmingham Chamber of Commerce. He is a member of the Engineering and Allied Employers' Association.

MR. JAMES COWPER has been appointed London representative of the Swan, Hunter, & Wigham Richardson, Limited, shipbuilding group, including Barclay, Curle & Company, Limited, and the Wallsend Slipway & Engineering Company, Limited. He has represented the last-named company at its London office since 1943.

MR. JOHN D. HULLOCK, A.M.I.MECH.E., for the past five years centrifugal foundry manager for Sheepbridge Stokes, Limited, Chesterfield, has been appointed general (foundries) manager with the Clay Cross Company, Limited, of Clay Cross, Derbyshire. He succeeds MR. W. BRADLEY, who has been with the Clay Cross Company, Limited, for the past eight years and has moved to Scotland.

THE HON. R. A. BALFOUR, managing director of Arthur Balfour and Company, Limited, Capital Steel Works, Sheffield, has been elected deputy president of the Association of British Chambers of Commerce. Mr. Balfour, the eldest son of Lord Riverdale, is also chairman of Tinsley Rolling Mills Company, Limited, and was Sheffield's Master Cutler in 1946-7, and president of Sheffield Chamber of Commerce 1949-50.

MR. K. J. SHONE, head of the department of industrial administration at the Royal Technical College, Glasgow, is making a trip to America under the auspices of the Foreign Operations Administration of the U.S. to study the interrelations between universities and industry in the field of management education. Mr. Shone intends to divide his time in America between universities and factories, and will study large and small firms.

MR. LESLIE O'CONNOR has been appointed chairman of the council of the British Coke Research Association in succession to MR. G. A. HEBDEN, who has retired after serving as chairman for a period of five years. SIR CHARLES ELLIS, scientific member of the National Coal Board, DR. R. J. MORLEY, director-general of carbonization, N.C.B. and MR. S. KELLETT, of the South Yorkshire Chemical Works, Limited, Rotherham, have been appointed members of the council.

MR. S. C. BOND, transport and shipping manager of Stanton Ironworks, Limited, Derbyshire, has been elected president of the Traders' Road Transport Association, and of its national council. In February he was elected chairman of the Association's national council. At the annual meeting of the association on May 28, Colonel Arthur Jerrett relinquished the office of president on health grounds and Mr. Bond was elected to the dual position. Mr. Bond was appointed chairman of the Eastern Midlands Division of the Association nine years ago and held the office until he was appointed to the national chairmanship.

MR. R. G. HULL, manager of the Manchester sales office of Northern Aluminium Company, Limited, London, W.C.2, retired last week. He joined the Birmingham sales office in 1927 and after 14 months opened the sales office in Manchester, where he worked until September, 1939, when he moved to the Banbury office. He was later transferred to the technical sales department at the company's Birmingham works, and in May, 1945, took up his position as Manchester sales area manager. He has been succeeded by MR. D. A. CORBETT-THOMPSON, who was formerly on the staff of the company's London sales office.

MR. J. M. RIDGION has been appointed deputy head of the British Iron and Steel Research Association's ironmaking division and head of the association's North-East Coast Laboratories at Normanby, near Middlesbrough. Mr. Ridgion, who is 42, has been engaged on co-operative research work in the iron and steel industry since 1936, when he joined the technical department of the British Iron and Steel Federation and worked under B.I.S.R.A.'s predecessor, the Iron and Steel Industrial Research Council. Before that he had been engaged on research in physical chemistry at Armstrong College, Newcastle-upon-Tyne. He is an honours graduate in chemistry of the Royal College of Science, London.

## Obituary

MR. ALFRED BARNSLEY,* a director of William Barnsley, Limited, non-ferrous founders, of Bilston (Staffs), has died at the age of 74.

MR. JAMES YOUNG, chairman of W. H. Arnott, Young & Company, Limited, iron and steel scrap and non-ferrous metal merchants, shipbreakers, etc., of Glasgow, died recently at the age of 70. He was one of the founders of the firm in 1912 and became chairman in 1938.

MR. A. J. STURGEON, managing director of Foster Electrical Supplies, Limited, London, S.W.19, and a director of Foster Transformers, Limited, died on May 26, at the age of 66. His association with the Foster organization, which is part of the Lancashire Dynamo group, began in 1911, and when, in 1944, it was decided to form Foster Electrical Supplies, he became the first managing director.

* See Also "Correspondence," JOURNAL, June 11, 1953, p. 666. Editor.

# Mechanical Handling

*Exhibition and Convention, June 9 to 19*

Among the speakers at the opening luncheon of the Mechanical Handling Exhibition and Convention yesterday at Olympia, was Mr. D. Cherry Paterson (director, Paterson Hughes Engineering Company, Limited) president of the Mechanical Handling Engineers' Association. The exhibition was formally opened by A. R. W. Low, M.P., Parliamentary Secretary to the Ministry of Supply. It remains open until June 19 (10 a.m. to 6 p.m. except June 14 and June 17 when it closes at 9 p.m.). Among highlights of the exhibition are giant mobile cranes with jibs nearly reaching the roof, (100 ft.); new hydraulic lorry loaders operated by drivers without help, an electric tractor with a turning radius of 70 in., a pneumatic conveyor plant, an automatic packing machine which straps and secures irregularly-shaped packages with steel bands, and fork-lift trucks capable of new feats in lifting and stacking. The bulk of the exhibits of 200 manufacturers are seen in operation.

Among the very many stands of interest to foundrymen, the following have been selected for brief review:—

E. BOYDELL & COMPANY, LIMITED, on stand C20b, show specimens of their well-known S.S. mechanical loader, a shunter, and, of special interest, the LH-1 hydraulic loader specially designed for working in small, confined spaces.

THE LANCASHIRE DYNAMO GROUP of companies, on stand C.17, have a specially-arranged exhibit, operating under working conditions, to illustrate the compactness and particular suitability of their range of motors for driving mechanical-handling plant.

DUNLOP RUBBER COMPANY, LIMITED, products on stand G. 3 include general rubber goods; conveyor belting (fire-resistant to N.C.B. standards); corrosion-resistant linings for plant and pipes; and flexible silicone-rubber products for conditions of temperature such as are experienced in shell moulding.

BRITISH INSULATED CALLENDER'S CABLES, LIMITED, on stand 0.6, are displaying a comprehensive selection of current-collection equipment for cranes, conveyors and electric haulage. This will include copper sections for rigid conductors, various kinds of grooved trolley-wire, extensible, tough-rubber-sheathed flexible cords, trailing cables and lift "flexibles."

MAVOR & COULSON, LIMITED, 36 Victoria Street, London, S.W.1, on stand B.8, are showing (running), a short sectional belt-conveyor, of the type widely used for outdoor work. There are several kinds of idler rollers, some dismantled, some cut in section, some running. In addition, conveyor engineers are on hand to help with any question of belt conveying. A special notebook has been produced by the firm for the exhibition.

DESIGNED AND MANUFACTURED by the Montgomerie Reid Engineering Company, Limited, Bramley, near Basingstoke, Hants, the firm's power loader model "8/10" is on show for the first time, on stand F. 11 B. This is a light-weight electrically-propelled (battery) fork-lift truck with hydraulic power lift. Extremely manœuvrable and easily operated, it is suitable for use in confined spaces and upper stories. The capacity is 8 cwt. at 15 ft. or 10 cwt at 10 ft. from the heel of the fork; the maximum lift is 60 in.; and unladen weight 1,120 lb. (approx.).

ANOTHER FIRM specializing in lift trucks—Conveyancer Fork Trucks, Limited, of Liverpool Road, Warrington, Lancs—has as its principal exhibits model E2-20/3W, a three-wheel battery-electric truck fitted with a 12-ft. mast; model E4-20, similar but to take 4,000 lb. at 20-in.-load centre instead of 2,000 lb.; model E6-20, which takes 6,000 lb. at 24 in.; D4-24, a Diesel-powered fork truck of 4,000-lb. load capacity at 24 in.; model F.T.C. 4/20 (flameproofed I.C.-engine truck); and model T.C. 6-20, another Diesel-engine fork truck fitted with a torque converter transmission and power steering.

RANSOMES AND RAPIER, LIMITED of Waterside Works, Ipswich and 32 Victoria Street, London, S.W.1, are exhibiting the following from their range of machines on stand C.12: Model 10 Super mobile crane (a machine exhibited for the first time). It is mounted on pneumatic tyres, has a full circle slewing superstructure and handles 10-ton loads at 10-ft. radius giving 5 ft. 6in. clear outreach, or with a long jib extension (as exhibited) lifting 2½ tons 50 ft. at 26-ft. radius. The drive is petrol-electric or Diesel-electric. A fork-lift truck, a shop truck crane and a wharf winch complete the main items.

YET ANOTHER wide range of fork-lift trucks and ancillary equipment is shown on the I.T.D., Limited, stand (D.3). Here, equipment displayed for the first time includes the modified battery-electric Stacatruc fork-lift truck, model 45EH (load capacity of 4,500 lb.); a new Diesel-powered fork-lift truck, model 60DH, capacity of 6,000 lb. at a load centre of 24 in.; model 40DH, a truck powered by the Perkins P3 Diesel engine (5,000 lb. at a lift height of 9 ft.). Also on view are the Electricar industrial 1-ton platform truck, model TLR6; and the Portapal pallet transporter, capacity 2 tons.

LANSING BAGNALL, LIMITED, Basingstoke, Hampshire, on stand D.6 feature and demonstrate for the first time some entirely new products, as well as equipment from their standard range. One new product, is SFR 225 model straddle fork reach truck. Prominent also is the Diesel fork truck, FD 223, which made its debut at the recent British Industries Fair. Two new items for use on this and other fork trucks are a clamp attachment and a rotating head. Among other items on view from the entirely British range of trucks produced by this firm will be models from the TD 200 range of tractors, and the PP 230 power pallet-truck.

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## G.E.C. Kiln for East Africa

To overcome a "bottleneck" in East African housing schemes and meet the demand for cheap and speedy building, the Uganda Public Works Department has decided to make its own tiles and cellular blocks. For this purpose, an electric kiln has been erected at Jinja, where there is a good supply of suitable clay as well as adequate power from the Owen Falls hydro-electric scheme. The kiln, the first all-electric tunnel kiln to be installed in East Africa, is capable of firing 2,200 tons per annum, at a temperature of 850 deg. C., and was designed and built in England by the General Electric Company, Limited. Its erection on site, together with the erection of the necessary buildings to house it, was carried out by the Uganda Public Works Department. The kiln, which has preheating, firing, and cooling sections, has an effective length of 100 ft. Heating in the kiln is by nickel/chrome elements 0.20-in. dia. formed into 1¼-in. dia. spirals, each of which rests in refractory brickwork grooved to receive it. The firing section has automatic temperature control. Bogies which carry the clay products through the kiln have side-angle runners which move in a sand trough to effect a furnace seal.

# News in Brief

AN ABLUTIONS BLOCK has been opened by James & Ronald Ritchie, Limited, at its Acklam, Middlesbrough, foundry, at a cost of £11,000.

THE 1954 ANNUAL CONFERENCE of the Institute of Vitreous Enamellers will be held in Manchester from October 7 to 9, with headquarters at the Midland Hotel.

AN "OPEN DAY" was held at the Loughborough works of Brush Electrical Engineering Company, Limited, recently. The general public was admitted and there were some 4,000 visitors.

THE MIDLANDS BRANCH of the Atlas Diesel Company, Limited, Wembley (Middx), has moved to larger premises at 1, Mary Street, Walsall, Staffs (telephone: Walsall 3510). Mr. W. A. Hood is branch manager.

A BOOKLET has been published by the Federation of British Industries, which describes recent progress in the F.B.I.'s scheme for bringing to Britain young graduate engineers from the less developed countries for practical training.

FOUR SALESMEN'S CARS have been furnished with two-way radio equipment by Central Manufacturing & Trading (Dudley), Limited, industrial conveyor equipment merchants, asbestos makers, etc., to facilitate sales service.

NEW OFFICERS of the Birmingham Metallurgical Society which held its annual meeting on May 31 are: *president* Mr. H. Evans; *vice-presidents* Dr. C. E. Homer, Dr. R. King, Mr. H. H. Symonds and Mr. R. Chadwick; and *hon. treasurer* Mr. A. C. Craig.

THE International Bank for Reconstruction and Development has granted a 20-year loan of £5,000,000 for the construction of a natural-gas pipeline in West Pakistan. The total cost of the project, which is expected to be completed by May, 1955, will be about £9,000,000.

THE section of the report on the Census of Production for 1951 for Starch (vol. 9, trade E) has been published, and copies may be obtained from H.M. Stationery Office at York House, Kingsway, London, W.C.2, and branches, or from any bookseller, price 1s. 6d. net.

THE TECHNICAL JOURNAL of the Brush Group, a quarterly which was first published in April, 1953, has been awarded a certificate of merit by the International Council of Industrial Editors. Among 955 entries from all over the world, it was the only U.K. publication to win a prize.

A STATUTE has been promulgated at Oxford University establishing a Readership in Metallurgy to commemorate the late Dr. George Kelley, who was managing director of the Pressed Steel Company, Limited. The company is establishing the Readership for further research in the study.

MORE THAN 5,000 news letters are being sent by the North-East Engineering Bureau to potential customers at home and overseas in an effort to bring more orders to north-east engineering firms. The letters will be followed by a buyers' guide giving details of the products of the 125 firms who are members of the Bureau.

A DIESEL ENGINE, manufactured by J. & H. McLaren, Limited, Leeds, has been chosen to power a new machine built for British Railways. The machine, which is for clearing railway sidings, can clear 3 tons of *débris* per man per hour from between the tracks, or four times more than by hand loading methods. The machine was built by Rownson, Drew & Clydesdale, Limited, London, E.C.4.

THE BOARD OF TRADE give notice that they are considering an application for exemption from import duty of copper, unwrought whether refined or not, in the form of shot and granules. Any representations which interested parties may wish to make in regard to this application should be addressed in writing to the Board of Trade (I.M.1 Division), Horse Guards Avenue, London, S.W.1, not later than June 26, 1954.

THE BRITISH TRANSPORT COMMISSION has placed an order with the English Electric Company, Limited, for 170 sets of power equipment for 350 h.p. Diesel-electric shunting locomotives for British Railways. This is the largest single order so far placed under the railways' programme to provide 573 Diesel shunting engines between 1953 and 1957. Of the present order, 78 power units will be delivered next year and the remaining 92 in 1956.

THE FIRST of the two 61-mva, 15.5-kv generating sets at the Cabril power station of the Hidro-electrica do Zezere in Portugal was commissioned on May 20. The dam, which is 433 ft. high, is one of the highest in Europe, and the generating sets are among the largest installed. The mechanical and electrical equipment has been supplied and installed by the English Electric Export & Trading Company, Limited, and Metropolitan-Vickers Electrical Export Company, Limited.

THE BOARD OF DIRECTORS of Joseph Sankey and Sons, Limited, Bilston, announced on June 5 that, on his doctor's advice, Colonel H. B. Sankey has relinquished his position as managing director. He will, however, remain chairman of the company. Succeeding Col. Sankey is Mr. H. F. Hodgson, for many years a director and general manager of the firm's Hadley Castle Works, Wellington, Shropshire. Mr. Geoffrey B. Sankey, also a director, has been appointed general manager at Hadley Castle.

A NEW, low-hydrogen electrode known as "Fortrex 35," has recently been developed by Murex Welding Processes, Limited, Waltham Cross, Herts. Features claimed for this electrode are that it is simple to use in any position; it is smooth running and the slag can be easily removed. It gives sound radiographs even in positional welds and the weld deposit has high impact values at sub-zero temperatures. It can be used for the welding of carbon and low-alloy steels normally outside the welding range, often without the need for preheating.

THE QUESTION of holidays with pay was one of the main items on the agenda at the 37th Session of the International Labour Conference which opened at Geneva on June 2. Other items listed for consideration were vocational rehabilitation of the disabled, migrant workers in underdeveloped countries and penal sanctions for breaches of contract of employment. The agenda also included the report of the director-general, financial and budgetary questions, and information and reports on the application of conventions and recommendations.

THE COUNCIL of the Institution of Production Engineers announce that a prize essay competition will be arranged in connection with the Production Exhibition and conference to be held at Olympia from July 7 to 14. Competitors, who will be classified in two age groups—15 to 18 and 18 to 21—will be invited to submit essays on the theme: "What I have learned from the production exhibition and conference." Three cash prizes will be awarded in each age group for the best essays received. Further details of the awards and conditions of entry will be announced later.

You can be assured of

NON-FERROUS METALS
Ingots to Standard
GUARANTEED SPECIFICATIONS

from

AUSTINS

METAL MANUFACTURERS SINCE 1870

E. AUSTIN & SONS (LONDON) LTD
HACKNEY WICK, LONDON, E.9. TEL: AMHERST 2211

# Imports and Exports of Iron and Steel in April

*The following tables, based on Board of Trade returns, give figures of imports and exports of iron and steel in April. Totals for the first four months of this year and last are also included.*

### *Total Exports of Iron and Steel*

| Destination. | Month ended April 30. | Four months ended April 30. | |
|---|---|---|---|
| | 1954. | 1954. | 1953. |
| | Tons. | Tons. | Tons. |
| Channel Islands | 252 | 1,418 | 1,288 |
| Cyprus | 961 | 2,043 | 4,074 |
| Sierra Leone | 850 | 5,274 | 1,470 |
| Gold Coast | 3,685 | 14,286 | 13,390 |
| Nigeria | 4,240 | 19,321 | 14,287 |
| Union of South Africa | 3,302 | 13,343 | 52,592 |
| Northern Rhodesia | 305 | 1,801 | 7,904 |
| Southern Rhodesia | 4,113 | 12,758 | 17,683 |
| Tanganyika | 924 | 3,750 | 4,740 |
| Kenya | 6,773 | 23,842 | 21,555 |
| Uganda | 457 | 2,619 | 1,825 |
| Mauritius | 280 | 2,664 | 2,324 |
| Bahrein, Qatar, and Trucial Oman | 1,432 | 10,268 | 7,275 |
| Kuwait | 139 | 3,037 | 4,406 |
| India | 6,047 | 30,357 | 17,814 |
| Pakistan | 4,330 | 16,751 | 10,034 |
| Singapore | 1,482 | 10,375 | 8,480 |
| Malaya | 2,390 | 8,490 | 10,637 |
| Ceylon | 1,282 | 5,292 | 5,748 |
| British North Borneo | 120 | 1,174 | 1,623 |
| Hongkong | 1,608 | 6,106 | 9,169 |
| Australia | 21,571 | 70,505 | 51,958 |
| New Zealand | 15,857 | 58,804 | 40,041 |
| Canada | 18,049 | 58,860 | 52,717 |
| Jamaica | 1,028 | 4,671 | 3,330 |
| Trinidad | 2,654 | 13,989 | 12,616 |
| British Guiana | 298 | 1,483 | 1,888 |
| Anglo-Egyptian Sudan | 2,469 | 11,781 | 8,723 |
| Other Commonwealth countries | 2,428 | 10,794 | 19,272 |
| Eire | 4,206 | 15,762 | 12,858 |
| Soviet Union | — | — | 2 |
| Finland | 5,113 | 18,156 | 11,074 |
| Sweden | 5,139 | 26,370 | 25,785 |
| Norway | 7,283 | 28,081 | 21,068 |
| Denmark | 7,930 | 31,144 | 29,871 |
| Western Germany | 476 | 2,048 | 2,092 |
| Netherlands | 6,509 | 32,299 | 40,952 |
| Belgium | 765 | 3,788 | 5,604 |
| France | 468 | 1,767 | 2,276 |
| Switzerland | 1,263 | 3,748 | 3,000 |
| Portugal | 927 | 3,719 | 5,129 |
| Spain | 622 | 1,358 | 1,336 |
| Italy | 8,302 | 19,630 | 14,685 |
| Austria | 236 | 456 | 386 |
| Yugoslavia | 570 | 1,710 | 1,151 |
| Turkey | 2,288 | 4,112 | 3,632 |
| Netherlands Antilles | 354 | 1,576 | 4,034 |
| Portuguese E. Africa | 330 | 939 | 1,151 |
| Lebanon | 67 | 568 | 1,975 |
| Israel | 284 | 4,015 | 2,342 |
| Egypt | 5,252 | 14,697 | 9,650 |
| Saudi Arabia | 458 | 1,049 | 310 |
| Iraq | 4,515 | 12,554 | 15,217 |
| Iran | 423 | 1,774 | 1,452 |
| Burma | 1,230 | 3,440 | 2,438 |
| Thailand | 1,288 | 2,883 | 3,867 |
| Indonesia | 410 | 2,053 | 3,812 |
| Philippine Republic | 785 | 1,642 | 611 |
| U.S.A. | 1,509 | 8,504 | 9,606 |
| Colombia | 323 | 2,235 | 3,044 |
| Venezuela | 2,960 | 11,413 | 17,441 |
| Ecuador | 146 | 972 | 996 |
| Peru | 181 | 1,044 | 2,554 |
| Chile | 129 | 452 | 724 |
| Brazil | 126 | 247 | 1,174 |
| Uruguay | 2,578 | 7,272 | 297 |
| Argentina | 6,462 | 25,495 | 4,909 |
| Other foreign countries | 13,067 | 28,537 | 10,040 |
| TOTAL | 204,300 | 753,365 | 687,907 |

MORE THAN 2,000 EMPLOYEES of the Stanton Ironworks Company Limited, were present when Mr. Bert Mozley of Derby County Football Club opened their first annual sports and gala on the Riddings works sports ground, on June 5.

### *Total Imports of Iron and Steel*

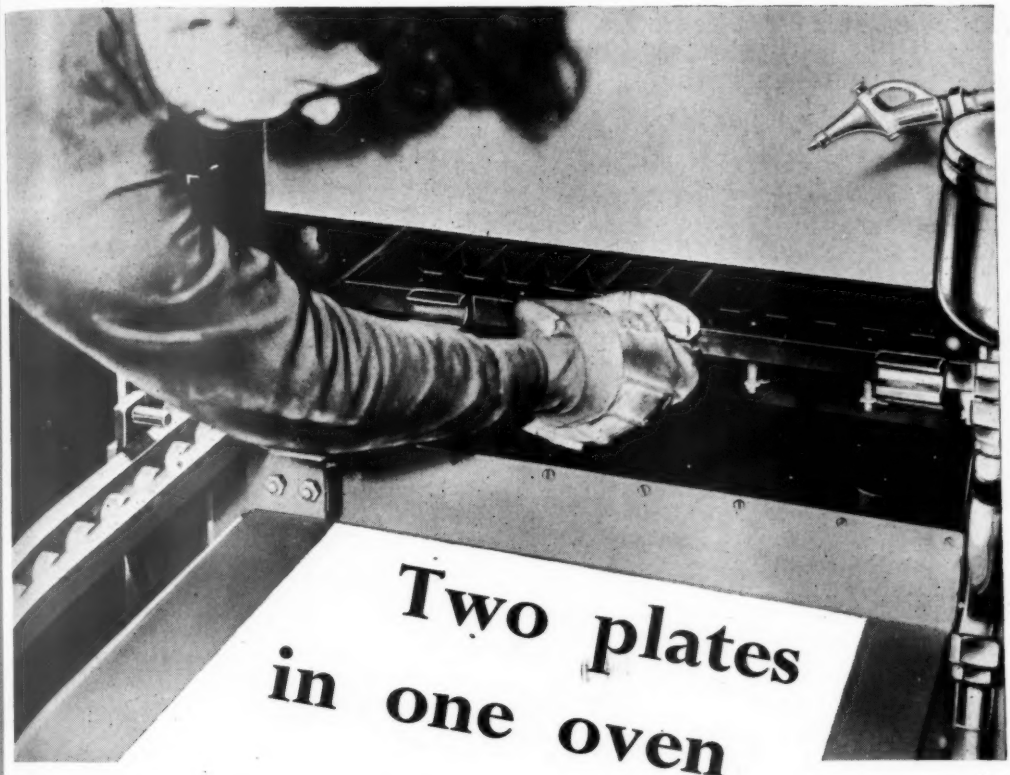
| From | Month ended April 30. | Four months ended April 30. | |
|---|---|---|---|
| | 1954. | 1954. | 1953. |
| | Tons. | Tons. | Tons. |
| Canada | 1,509 | 1,757 | 53,143 |
| Other Commonwealth countries and Eire | 914 | 8,304 | 37,445 |
| Sweden | 800 | 11,711 | 6,601 |
| Norway | 3,597 | 9,353 | 19,995 |
| Western Germany | 3,265 | 39,487 | 6,934 |
| Netherlands | 5,409 | 34,292 | 37,874 |
| Belgium | 939 | 18,168 | 97,200 |
| Luxembourg | 492 | 8,136 | 45,384 |
| France | 3,219 | 29,070 | 114,681 |
| Italy | 26 | 2,689 | 5,638 |
| Austria | 3,399 | 75,536 | 138,852 |
| Japan | — | 15 | 42,709 |
| U.S.A. | 7,967 | 36,109 | 92,661 |
| Other foreign countries | 25,961 | 63,350 | 22,324 |
| TOTAL | 57,497 | 337,977 | 721,441 |
| Iron and steel scrap and waste, fit only for the recovery of metal | 72,325 | 286,094 | 242,433 |

### *Exports of Iron and Steel by Products*

| Product. | Month ended April 30. | Four months ended April 30. | |
|---|---|---|---|
| | 1954. | 1954. | 1953. |
| | Tons. | Tons. | Tons. |
| Pig-iron | 1,338 | 3,889 | 2,203 |
| Ferro-tungsten | 84 | 156 | 21 |
| Other ferro-alloys | 2,834 | 4,053 | 956 |
| Ingots, blooms, billets, slabs, sheet and tinplate bars | 91 | 1,278 | 167 |
| Iron bars, rods, and sections | 239 | 878 | 825 |
| Steel bars, rods, sections, and shapes | 26,840 | 95,449 | 98,745 |
| Iron plates and sheets | 35 | 313 | 162 |
| Universal plates | 384 | 2,334 | 4,292 |
| Steel plates, ⅛ in. and under ¼ in. | 1,015 | 3,629 | 2,985 |
| Do., ¼ in. and over | 12,225 | 49,450 | 73,211 |
| Black sheets and black plate | 15,218 | 67,364 | 44,070 |
| Hoop and strip | 12,428 | 38,506 | 15,908 |
| Tinplate | 30,374 | 104,389 | 89,914 |
| Tinned sheets, terneplate, and terne sheets | 181 | 854 | 611 |
| Decorated tinplate | 73 | 778 | 611 |
| Galvanized sheets | 13,689 | 55,057 | 32,675 |
| Other coated plates and sheets | 769 | 2,864 | 3,736 |
| Railway and tramway construction material | 21,323 | 81,128 | 90,061 |
| Wire rods | 2,507 | 10,154 | 3,963 |
| Wire | 7,315 | 24,602 | 15,256 |
| Tubes, pipes, and fittings | 53,947 | 199,397 | 203,715 |
| Iron castings | 909 | 4,157 | 840 |
| Steel castings | 136 | 1,398 | 1,053 |
| Forgings | 316 | 1,288 | 1,927 |
| TOTAL | 204,300 | 753,365 | 687,907 |

## B.S.I. Information

The British Standards Institution information sheet for April lists, under "new standards issued," B.S. 2094: 1954, Glossary of terms relating to iron and steel, part 4, "Steel sheet and strip," and part 6, "Forgings and drop forgings" (both 2s. 6d.). New work has been started on testing of overhead runways, and reprints include B.S. 240 Pt. 1:1937, "Methods and tables for Brinell hardness testing" (4s.).

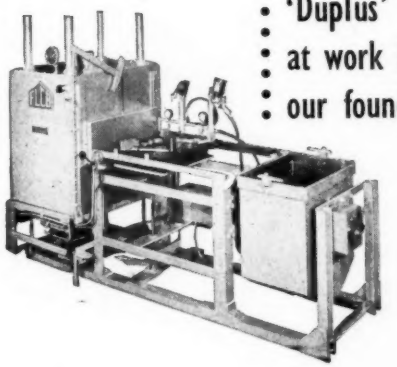


# Two plates in one oven

The single oven of the Shelmolda Duplus does the work of two. While one shell is being cured the other patternplate is being invested with a new shell. Because of this unique feature the operator's "time and motion" is reduced and the floorspace required is kept down to 8ft. 6in. by 3ft. 3in. Can you get, anywhere, a greater output, or a lower running cost in a machine at this price?

*OUTPUT:* 50/60 moulds per hour. *DELIVERY:* 8/10 weeks. *PRICE:* £575.

**May we show you the Shelmolda 'Duplus' at work in our foundry?**



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**DUPLUS**

(Patent Applied For)

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236.61

# Raw Material Markets

## Iron and Steel

The increased prices of foundry pig-iron and hematite will add considerably to production costs, and although some of the additional charges have not been included in the price of castings, the increases will inevitably result in higher prices which will be detrimental in securing orders, particularly for the overseas markets. The foundries are faced with severe competition, a factor which is especially disturbing to the light-castings trade, in which orders for both home and export are much below the required level. The foundries generally view the position with concern, as one increase follows another at a time when some incentive to buy is needed.

Among the foundries, the engineering and speciality undertakings are the most favourably situated for castings for both home and export. The supply of low- and medium-phosphorus iron is stringent and it is also difficult to secure the desired analyses in hematite pig-iron, particularly in the higher silicon ranges, many producers having commitments with the steelworks which absorb most of their outputs. The supply of high-phosphorus pig-iron is adequate.

Scrap deliveries are sufficient to cover consumption and, in many instances, to augment stocks, while there is no difficulty in obtaining foundry coke, limestone, ganister, and firebricks.

There are signs of more home market interest in re-rolled bars and light sections, while some tonnages have been booked for shipment. This is reflected in a somewhat better demand from the re-rollers for billets, all of which can be obtained from home makers. Producers of bars were granted an increase of 2s. 6d. per ton on their products as from May 31, but they have not been called upon to pay a higher price for billets. The slight improvement in trade for bars and light sections is welcome, but much more business is needed to enable the re-rollers to achieve capacity outputs. Sheet re-rollers are busy and those producing strip are now better employed. Demands for sheet bars and slabs are being implemented. The call for untested steel is growing, but most steelworks are not prepared to supply this grade. Slightly defective billets are in heavier request.

## Non-ferrous Metals

The upward trend in zinc and lead which has been so noticeable of late was to the fore again last week, when the prices of these two metals advanced in the United States, presumably on expectations that the rumours and reports regarding further stockpiling by the American authorities are correct. Zinc, which had previously moved up by ¼ cent to 10¼ cents, put on ½ cent to 11 cents, equal to £88, while lead appreciated by ¼ cent to 14¼ cents per lb., or £114 per ton. In Whittington Avenue zinc was bid up to £82, but finished at £81 7s. 6d. June and £81 10s. September, a gain of £1 7s. 6d. for the early position and £1 forward. Trading was fairly brisk. Lead touched £99 10s. during the week, but fell back to close at £98 for first half June, and £95 10s. for first half September. The backwardation widened to £2 10s. and on balance the early position gained £1 15s. and forward 10s. Tin was easier and closed £6 10s. lower for cash and £5 down for three months, the backwardation being only 10s.

After months of argument and discussion it seems that the Texas tin smelter in the United States will continue to function beyond the end of the present month and may well carry on for another year or so. There is talk of a contract being arranged with Bolivia for a supply of concentrates.

Activity in Northern Rhodesia has been curtailed due to fuel shortage and it is reported that a resort will be had to oil burning in order to help out the lack of sufficient coal. Wood burning for steam raising, etc., has been a feature for a number of years now and this is likely to continue until the schemes for providing additional electric power get under way. Those in touch with events on the spot maintain that matters will come right and that in due course interference with output for the causes at present operating will be a thing of the past. Obviously, if the plans for expanding production on the Copperbelt are to come to fruition, steps must be taken to overcome the oft recurring troubles that arise from the periodic spells of fuel shortage in Northern Rhodesia. At the moment it certainly looks as if there may be some delay in projected shipments of copper.

Official metal prices were as follow:—

COPPER, Standard—*Cash:* June 3, £239 to £239 5s. June 4, £237 10s. to £238; June 8, £237 to £237 5s.; June 9, £236 15s. to £237.

*Three Months:* June 3, £236 15s. to £237; June 4, £236 to £236 5s.; June 8, £236 to £236 5s.; June 9, £235 15s. to £236.

TIN, Standard—*Cash:* June 3, £726 10s. to £727; June 4, £721 10s. to £722 10s.; June 8, £723 to £724; June 9, £722 to £722 10s.

*Three Months:* June 3, £726 to £727; June 4, £721 10s. to £722; June 8, £723 to £724; June 9, £722 to £722 10s.

ZINC—*June:* June 3, £81 10s. to £81 12s. 6d.; June 4, £81 5s. to £81 7s. 6d.; June 8, £80 17s. 6d. to £81 2s. 6d.; June 9, £80 10s. to £80 12s. 6d.

*First half September:* June 3, £81 12s. 6d. to £81 15s.; June 4, £81 7s. 6d. to £81 10s.; June 8, £81 to £81 5s.; June 9, £80 12s. 6d. to £80 15s.

LEAD—*First half June:* June 3, £98 to £98 5s.; June 4, £97 15s. to £98; June 8, £97 15s. to £98 5s.; June 9, £97 to £97 10s.

*First half September:* June 3, £96 to £96 5s.; June 4, £95 to £95 10s.; June 8, £95 to £95 5s.; June 9, £94 10s. to £94 15s.

# Board Changes

NU-WAY HEATING PLANTS, LIMITED, Droitwich—Mr. C. V. Miller has been appointed to the Board.

A. REYROLLE AND COMPANY, LIMITED, electrical engineers and manufacturers—Mr. Harold Hill Mullens has been co-opted as a director and appointed managing director.

VICKERS, LIMITED—Mr. D. L. Pollock has joined the Board. He is a director of S. Pearson & Son, Limited, Legal & General Assurance Society, Limited, Westminster Bank, Limited, and other companies.

B.S.A. TOOLS, LIMITED; LEO. C. STEINIE, LIMITED, AND CARDIFF FOUNDRY AND ENGINEERING COMPANY (1947) LIMITED—Mr. S. A. Roberts of Sutton Coldfield, who became general manager to the B.S.A. Tools Group in 1953, has now been appointed to the board of directors of these companies of the Group.

PARSON & CROSSLAND, LIMITED—Mr. Kenneth F. Suggett has been appointed director and secretary in place of Mr. T. Hyde Robertson who has resigned. Mr. Robertson has assumed special responsibilities within the Group. Mr. Lionel Butler-Henderson, for health reasons, has resigned his executive position with the company but remains on the board.